DOCUMENT RESUME

ED 170 568 CE 021 386

AUTHOR	Fenton, Joseph, Ed.; Sigman, David I., Ed.
TITLE	Research Directory of the Rehabilitation Research and Training Centers. Fiscal Years 1976 and 1977.
INSTITUTION	Arkansas State Rehabilitation Research and Training Center, Fayetteville.
SPONS AGENCY	Office of Human Development (DHEW), Washington, D.C.
PUB DATE	Nov 77
NOTE	584p.; For a related document see CE 021 387
EDRS PRICE	MF03/PC24 Plus Postage.
DESCRIPTORS	Daily Living Skills; *Deaf Research; *Educational Research; *Medical Research; *Mental Retardation; *Rehabilitation; Rehabilitation Centers; Research Projects; Research Utilization; *Vocational Education; Vocational Training Centers

ABSTRACT

This seventh edition of the Rehabilitation Research and Training (RT) Centers reports the FY 1976/77 research activities of nineteen RT Centers (twelve medical, three vocational, three mental retardation, and one deafness). These research activities focus primarily on the production of new knowledge which will improve rehabilitation methodology and service systems, alleviate or stabilize handicapping conditions, and promote maximal social and economic independence. The 417 abstracts included in this directory are organized under the conducting RT Centers which are located at the following institutions: New York University, University of Minnesota, University of Washington, Baylor University, Emory University, Tufts University, Temple University, The George Washington University, University of Colorado, University of Wisconsin, University of Arkansas, University of West Virginia, University of Oregon, University of Southern California, University of Alabama, Northwestern University, Texas Tech University, University of Wisconsin-Stout. Preceding the abstracts under each RT Center are listings of that center's core areas of research, completed projects, continued projects, discontinued projects, new projects, and proposed projects. Each abstract includes project objectives, methodology, findings, and applicability. The name of the principal investigator, status of the research activity, and relevant fiscal data are included in bolder type. Both a subject index and principal investigators' index are provided. (BM)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED170568

RESEARCH DIRECTORY
# of the
REHABILITATION
RESEARCH AND TRAINING CENTERS

Fiscal Years 1976 and 1977

REHABILITATION SERVICES ADMINISTRATION
OFFICE OF THE ASSISTANT SECRETARY FOR HUMAN DEVELOPMENT SERVICES

Arabella Martinez
Assistant Secretary

Robert R. Humphreys
Commissioner, Rehabilitation
Services Administration

James F. Garrett, Ph.D.
Executive Director of
Research and Development,
Rehabilitation Services Administration

Joseph Fenton, Ed.D.
Chief, Special Centers

Emily Cromar
Research and
Training Associate,
Special Centers

DEPARTMENT OF HEALTH, EDUCATION, and WELFARE
Washington, D.C. 20201

November 1977

U S DEPARTMENT OF HEALTH.
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

CE 021 386

Information Exchange

Executive Editor: Joseph Fenton, Ed.D.

Prepared by the Information Exchange Program,
Arkansas Rehabilitation Research and Training Center,
University of Arkansas and Arkansas Rehabilitation Services.

David L. Sigman, Editor/Coordinator
Susan J. Weller, Research Associate, Materials Development
Robin K. Muse, Materials Development.

Cover:
Photograph by William A. Grunow, M.D., Assistant Professor
Department of Pathology,
University of Arkansas College of Medicine

Library of Congress Number
LCN 77-918-94

International Standard Book Number
ISBN 0-931026-00-8

CIP Information from the National Library of Medicine

HD 7256.U5 R432

Research Directory of the Rehabilitation Research and Training Centers.
1968/69 — Washington, Rehabilitation Services Administration.

This work was supported by a research and training center grant (16-P-56812, RT-13) from the Rehabilitation Services Administration, Office of Human Development Services, Department of Health, Education and Welfare.

INTRODUCTION

This FY 1976/77 Research Directory of the Rehabilitation Research and Training Centers (RT Centers) has been prepared for distribution to local, national, and international rehabilitation service agencies and institutions. It exemplifies another of the numerous efforts made by the Special Centers Office to accurately organize and disseminate information which can serve to reduce the gap between the production of new knowledge and its utilization. It further attempts to bring researchers, users, and sponsors of rehabilitation services into a closer relationship.

This seventh edition represents the coordinated efforts of 19 Rehabilitation Research and Training Centers (12 medical, 3 vocational, 3 mental retardation, and one deafness) which serve as unique RSA programs. The 417 abstracts included in this directory form a spectrum reflecting the continuous sequence of activities involved in the RT Centers' unique synergistic mission to: undertake research targeted toward the production of new knowledge which will improve rehabilitation methodology and service delivery systems, alleviate or stabilize handicapping conditions, and promote maximal social and economic independence; and secondly, to institute related teaching and training programs to disseminate and promote the utilization of the research findings, thereby reducing the usual long intervening delay between the discovery of new knowledge and its wide application in practice.

In addition to these primary goals, the RT Centers have additional training responsibilities which include: increasing the numbers of rehabilitation personnel in fields where acute manpower shortages exist; training rehabilitation research and service personnel; incorporating rehabilitation education into all rehabilitation related University undergraduate and graduate curricula; and improving skills of rehabilitation students, professionals, paraprofessionals, volunteers, consumers, parents, and other personnel currently participating in the rehabilitation process. These objectives are achieved through the media of short and long-term-inservice and continuing education programs including seminars, workshops, courses of study, conferences, and demonstrations - all for the ultimate purpose of favorably impacting and improving the effectiveness of those rehabilitation services that are assisting handicapped citizens to achieve the most productive lives possible.

In presenting the individual abstracts in this publication, researchers have supplied project objectives, methodology, and the progress and findings. The name of the principal investigator, status of the research activity, and relevant fiscal data are also included. Data for the FY 1977 reporting period is printed in **bolder type** for easy identification. To expedite the location of individual research abstracts, both a permuted subject index and a principal investigator index are provided. Each abstract is assigned an accession number which permits easy location.

The Project Director's name and the address of the Center are listed at the beginning of each Center's activity and again at the end of the Directory where it is accompanied by the name of the Director of Research. Requests for further information concerning individual research activities should be addressed **directly to the Project Director of the appropriate Center.**

Other publications concerned with the activities of the Special Centers include the **Informer,** a quarterly journal describing new research and training activities of the Centers; the Audiovisual Directory of the Research and Training Centers, a current listing published bi-annually; and the Training Directory of the Rehabilitation Research and Training Centers, an annual publication announcing forthcoming training programs which are made available through the University based RT Centers. Copies of each are available at no charge by writing the Special Centers Office, Rehabilitation Services Administration, Department of Health, Education and Welfare, 330 C Street, S.W. Washington, D.C. 20201.

Emily Cromar
Research and Training Associate,
Special Centers

Joseph Fenton, Ed.D.
Chief, Special Centers

CONTENTS

Page Number

Introduction iii

RT-1 Completed project listing 1
Continued project listing 2
New project listing 2
Discontinued project listing 3
Other project listing 4
New York University Medical Rehabilitation RT Center Abstracts 5

RT-2 Completed project listing 43
Continued project listing 43
New project listing 44
Discontinued project listing 44
Transferred project listing 45
Other project listing 45
University of Minnesota Medical Rehabilitation RT Center Abstracts 46

RT-3 Completed project listing 77
Continued project listing 78
New project listing 79
Discontinued project listing 80
Deferred project listing 81
Other project listing 81
Proposed project listing 81
University of Washington Medical Rehabilitation RT Center Abstracts 83

RT-4 Completed project listing 135
Continued project listing 136
New project listing 136
Discontinued project listing 136
Transferred project listing 137
Baylor University Medical Rehabilitation RT Center Abstracts 138

RT-6 Completed project listing 169
Continued project listing 169
New project listing 170
Transferred project listing 170
Revised project listing 170
Emory University Medical Rehabilitation RT Center Abstracts 171

RT-7 Completed project listing 185
Continued project listing 185
New project listing 186
Deferred project listing 186
Transferred project listing 186
Discontinued project listing 186
Proposed project listing 186
Tufts University Medical Rehabilitation RT Center Abstracts 187

RT-8 Completed project listing 215
Continued project listing 215
New project listing 216
Temple University Medical Rehabilitation RT Center Abstracts 217

RT-9 Completed project listing 237
Continued project listing 237
New project listing 238
Discontinued project listing 238
Transferred project listing 238
The George Washington University Medical Rehabilitation RT Center Abstracts 239

RT-10 Completed project listing 261
New project listing 261

Discontinued project listing 262
Proposed project listing 262
University of Colorado Medical Rehabilitation RT Center Abstracts 263

RT-11 Completed project listing 275
Continued project listing 276
Discontinued project listing 276
Terminated project listing 276
University of Wisconsin Mental Retardation Rehabilitation RT Center Abstracts 277

RT-13 Completed project listing 295
Continued project listing 296
New project listing 296
Discontinued project listing 297
Other project listing 298
University of Arkansas Vocational Rehabilitation RT Center Abstracts 299

RT-15 Completed project listing 339
Continued project listing 339
New project listing 339
Proposed project listing 340
University of West Virginia Vocational Rehabilitation RT Center Abstracts 341

RT-16 Completed project listing 357
Continued project listing 357
New project listing 357
Discontinued project listing 358
University of Oregon Mental Retardation Rehabilitation RT Center Abstracts 359

RT-17 Completed project listing 379
Continued project listing 379
New project listing 380
Concluded project listing 380
Other project listing 380
New York University Deafness Rehabilitation RT Center Abstracts 381

RT-18 Continued project listing 399
New project listing 399
University of Southern California Medical Rehabilitation RT Center Abstracts 400

RT-19 Completed project listing 407
Continued project listing 407
Discontinued project listing 408
Proposed project listing 408
University of Alabama Medical Rehabilitation RT Center Abstracts 409

RT-20 Completed project listing 429
Continued project listing 429
New project listing 429
Discontinued project listing 430
Other project listing 430
Proposed project listing 430
Northwestern University Medical Rehabilitation RT Center Abstracts 431

RT-21 Completed project listing 449
Continued project listing 449
New project listing 450
Discontinued project listing 450
Transferred project listing 450
Proposed project listing 450
Texas Tech University RT Center in Mental Retardation Abstracts 452

RT-22 Completed project listing 475
Continued project listing 475
Discontinued project listing 475

Other project listing 476
University of Wisconsin-Stout Vocational Rehabilitation RT Center Abstracts 477

Permuted Subject Index 489
Principal Investigators' Index 565
Addresses of Research and Training Centers 569

New York University (RT-1)
Medical Rehabilitation Research and Training Center

CORE AREAS

Neuromuscular Diseases

Activities designed to develop and apply new findings to aid in the rehabilitation of individuals with neuromuscular malfunction. These activities include evaluation techniques, research in neurophysiology and electrodiagnostics, with continuing application to the patient's functional abilities.

Orthotics-Prosthetics

Activities designed to yield immediate and practical improvements in the design and fitting of devices to aid amputees, as well as patients suffering from neuromuscular and / or skeletal disorders.

Behavioral Science

There are three foci to this program: a) Psycho-social behavior, b) Accountability, and c) Perceptual-cognitive disturbances in brain damaged persons. The program currently focuses on assessment intervention techniques and on the development of "rehabilitation indications"

Cardiopulmonary

Activities designed to aid in the remediation of deficits originating from respiratory and cardiac disorders. This includes both diagnostic and treatment aspects.

Bioengineering

Activities designed to meld engineering and medicine in the solution of disability related problems.

Regional Spinal Cord Injury Center

All of the above core areas interact and interface with the Regional Spinal Cord Injury Center (at the Institute of Rehabilitation Medicine and the Department of Neurosurgery, New York University Medical Center).

NEW YORK UNIVERSITY MEDICAL CENTER

Daniel McAlees, Ph.D., Director
New York University Medical Center
Rehabilitation Research and Training Center
400 East 34th Street
New York, New York 10016

PROJECT TITLES BY FY 1977 STATUS

ABSTRACT NO.

COMPLETED

A Controlled Study of Inhalational Therapy in the Rehabilitation of Patients with Chronic Obstructive Lung Disease (Edward H. Bergofsky, M.D.) 001

The Effect of Environmental Factors and Geographic Location on Vocational Rehabilitation and Job Status of Patients with Chronic Obstructive Lung Disease (Edward H. Bergofsky, M.D.) 002

Factors Influencing the Right Heart Failure of Patients with Chronic Pulmonary Disease and Their Influence on Work and Exercise Capacity (Edward H. Bergofsky, M.D.) 003

Use of Periodic Lung Expansion for the Facilitation and Rehabilitation and Prevention of Hospitalization in Patients with Poliomyelitis, Quadriplegia, Kyphoscoliosis, Muscular Dystrophy and Other Neuromuscular Diseases (Edward H. Bergofsky, M.D.) 004

Functional Skills Remediation in Hemiplegia: Assessment Model for Eye-Hand Skills (Leonard Diller, Ph.D.) 005

Remediation of Untreated Impairments (Leonard Diller, Ph.D.) 006

Sequential Circulatory Assist (Boguslav H. Fischer, M.D.) 007

Variable Inclination Mattress (Boguslav H. Fischer, M.D.) 008

Antithrombin III in Ischemic Thrombotic Vascular Disease (Robert H. Yue, Ph.D.) 009

The Hypercoagulable State in Thrombotic Disease (Formerly—Identification of the Stroke Prone Individual in the Covert State) (Menard M. Gertler, M.D.) 010

Ischemic Cerebrovascular Disease Study (Menard M. Gertler, M.D.) 011

Structure and Function of Factor X (Robert H. Yue, Ph.D.) 012

Driver Education and Research Project (Jack M. Hofkosh, M.S.) 013

Electrocardiographic Monitoring with Telementry During Physical Therapy (Masayoshi Itoh, M.D.) 014

Objective Evaluation of Lower Limb Blood Flow and Circulatory Reflexes in Patients with Advanced Aertariosclerosis Obliterans (Theobald Reich, M.D.) 015

Correlative Kinesiology (Erwin R. Tichauer, Sc.D.) 016

Temporal Factors in Recovery From Aphasia (Martha Taylor Sarno, M.A.) 017

CONTINUING

Regulation of Regional Intracerebral Circulation During Injury and Aging (J. N. Barker, Ph.D.)	018
Application of Ozone to Infected Wounds and Pressure Sores and in the Management of Chronic and Acute Urinary Tract Infections (Boguslav H. Fischer, M.D.)	019
Topical Hyperbaric Oxygen Treatment of Pressure Sores and Certain Skin Ulcerations (Boguslav H. Fischer, M.D.)	020
Zinc Sulphate in the Treatment of Various Skin Disorders (Boguslav H. Fischer, M.D.)	021
Electrophysiological Studies in Neuromuscular Diseases (Joseph Goodgold, M.D.)	022
Work Classification of Patients with Obstructive Pulmonary Disease Following Rehabilitation (Albert Haas, M.D.)	023
Orthotics and Prostetics Design Improvements (H. R. Lehneis, Ph.D.)	024
Bone Mineralization in Spinal Cord Injured Man: A Biochemical and Radiologic Investigation (N. Eric Naftchi, Ph.D.)	025
Sympathetic Activity and the Metabolism of Biogenic Amines in Spinal Cord Injured Patients (N. Eric Naftchi, Ph.D.)	026
Dysfunctions of Endocrine Glands in Spinal Cord Injury (N. Eric Naftchi, Ph.D.)	027
Evaluation of Various Electronic Devices to Increase Mobility and Independence of Very High Level Quadriplegic Patient (Above C5) (Heiner Sell, M.D.)	028
Demonstration of Benefits of Early Identification of Psychosocial Problems and Early Intervention Toward Rehabilitation of Cancer Patients (Leonard Diller, Ph.D.	029
Motor Conduction Velocity Measurement in Myotonic Distrophy (Arthur Eberstein, Ph.D.)	030
A Method for Enhancing Accountability (Leonard Diller, Ph.D.)	031
Modular Hyperbaric Oxygen Treatment of Pressure Sores and Traumatic Skin Lesions of the Torso (Boguslav H. Fischer, M.D.)	032

NEW

Pathomechanics of Upper Limbs as a Basis for Improved Prosthetic and Orthotic Design (Erwin R. Tichauer, Sc.D.)	033
The Significance of Slope and Duration Measurements in Sensory Nerve Action Potential Studies (Neil I. Spielholz, Ph.D.)	not initiated
Electromyography as an Adjunct to the Treatment of Idiopathic Scoliosis (Neil I. Spielholz, Ph.D.)	not initiated
Development of Electronic Systems to Provide Increased Vocational Independence and Recreational Facilities for High Level Quadriplegics (Above C5) (Calman Gold, M.E.)	034

The Diagnosis and Remediation of Deficits in Visual Information Processing and Verbal Abstraction in Brain Damaged Adults (Leonard Diller, Ph.D.) 035

Electronic Anal Sphincter Stimulation for Fecal Incontinence Control and Barium Enema Examination of Disabled Persons (Boguslav H. Fischer M.D.) 036

Feedback Control System for the Paralyzed (Warren Frisina B.E.) 037

Development of Transfer Devices for High Quadriplegic Patients (Robert G. Wilson M.S.) 038

DISCONTINUED FY 1976

The Use of Enriched Oxygen and Cognitive Training in the Rehabilitation of Senility and other Neurologic Disorders (Leonard Diller, Ph.D.)

The Application of F-Wave Responses to the Study of the Fatigue Process (Clinical Application of Maximal Power Output of Muscle and Spectrum Analysis of the Lateralization of Motor Function in Dominant and Non-Dominant Biceps Brachii) (Arthur Eberstein, Ph.D.)

Hyperbaric Oxygen Treatment of Meningomyelocoele (Boguslav H. Fischer, M.D.)

Ozone in the Early Management of Meningomyelocoele Lesions (Boguslav H. Fischer, M.D.)

Sphincter Stimulation in Spina Bifida Children (Boguslav H. Fischer)

The Evaluation of Cardiac Patients for an Exercise Rehabilitation Program (Menard M. Gertler, M.D.)

Identification of the Parameters Associated with Covert Strokes in Various Countries (Menard M. Gertler, M.D.)

The Anatomic, Biochemical and Epidemiological Aspects of Cardiac Rehabilitation (Menard M. Gertler, M.D.)

Longitudinal Study of the Effect of Rehabilitation on Factors Such as Job Placement Maintenance of Employment of Patients with Obstructive Pulmonary Disease (COPD) (Albert Haas, M.D.)

Pulmonary Impairment in Drug Addicts and its Relationship to Psycho-social and Vocational Rehabilitation (Albert Haas, M.D.)

Pathogenesis of Pulmonary Oxygen Toxicity: Significance of Circulating Biogenic Amines (Theobald Reich, M.D.)

Kitchen and Home Planning for the Physically Handicapped (Sharon Wright, B.S.)

A Study of Approximately 6,000 Patients with Congenital Cerebral Palsy and 316 Pairs of Twins in Which One Twin Member is Handicapped (Chester A. Swinyard, M.D., Ph.D.)

Pharmaco – Kinesiology (Erwin R. Tichauer, Sc.D.)

A National Survey of the Myelomeningocele Problem (Chester A. Swinyard, M.D., Ph.D.)

DISCONTINUED FY 1977

The Anatomic, Biochemical, and Epidemiological Aspects of Cardiac Rehabilitation (Menard M. Gertler, M.D.)

Rehabilitation of Cognitive and Perceptual Defects in People with Traumatic Brain Damage (Leonard Diller, Ph.D.)

Muscle Re-Education in the Hemiparetic Patient by Use of EMG Feedback (Leonard Diller, Ph.D.)

OTHER

An Electromyographic Study of Muscle Fatigue (Joseph Goodgold, M.D.)

Driver Education and Research Project (Jack M. Hofkosh, M.S.)

Study of Institutional Care for Severely Disabled Young Adults (Mathew Lee, M.D.)

Longitudinal Study of the Effect of Rehabilitation on Factors Such as Job Placement, Maintenance

Obstructive Pulmonary Disease (COPD) (Albert Haas, M.D.) (Request for extension)

Work Classification of Patients with Obstructive Pulmonary Disease Following Rehabilitation (Albert Haas, M.D.) (Request for extension)

001 A Controlled Study of Inhalational Therapy in the Rehabilitation of Patients with Chronic Obstructive Lung Disease

Principal Investigator: Edward H. Bergofsky, M.D.
1976
Status: Completed
Dates: July, 1969-July, 1975
Cost: Annual $12,045 Projected Total $92,000
RT Annual $4,945 RT % of Annual Total 41%
Annual Report Reference: #14, Page 17, R-4

OBJECTIVES:

1. To weigh the relative value of the two major approaches used in the rehabilitation of patients with chronic obstructive lung disease (inhalation and bronchial therapy versus breathing exercises);
2. To evaluate the therapeutic effects of bronchodilators, tracheobronchial humidification, mucolytic aerosols, and some sedatives and expectorants using double-blind protocols;
3. To determine the most efficacious combination or combinations of the above therapeutic measures and ascertain which combinations are best for each of the major clinical subdivisions of chronic obstructive lung disease;
4. To incorporate the results into rehabilitation programs.

METHODOLOGY:

1. Ultrasonic nebulization was administered to patients with chronic lung disease on alternate days with ordinary cool mist being administered on the other days for a total of 14 days.
2. Test of air flow rate using spirometry, plethysmography, timed vital capacity, and maximal expiratory flow rates was performed during the course of the morning after such nebulization along with measurement of sputum volume and weight.
3. The testing technique involves the use of the deposition and clearance of radioactively labelled aerosol particles. The rate at which these particles are cleared from the mucous membrane will be measured by whole body counting techniques during a control situation, and the effect of each treatment modality on this rate of clearance will be observed.

FINDINGS TO DATE:

1. Ultrasound nebulization lacks advantage over the usual forms of nebulization in addition to producing some deleterious effects, including a time span of several hours of increased disability due to water accumulation and swelling of secretions in the bronchi.
2. High amplitude vibration of the thorax by electromechanical means is preferable to the use of low amplitude vibration of the thorax by electromechanical means is preferable to the use of low amplitude force shock percussion.
3. The usefulness of acetylcystine inhalation has been confirmed along with propylene glycol in more mucoid sputums.

002 The Effect of Environmental Factors and Geographic Location on Vocational Rehabilitation and Job Status of Patients with Chronic Obstructive Lung Disease

Principal Investigator: Edward H. Bergofsky M.D.
1976
Status: Completed
Dates: July, 1970-July, 1974
Cost: Annual $2,875 Projected Total $150,000
RT Annual $575 RT % of Annual Total 20%
Annual Report Reference: #14, Page 21, R-5

OBJECTIVES:

1. To assess environmental factors and geographic location in rehabilitation and in maintenance of patients with chronic lung disease at work or in returning them to work after a period of vocational incapacity;
2. to determine environmental factors which delay vocational rehabilitation and limit work capacity in patients with chronic bronchitis, asthma, and emphysema.

METHODOLOGY:

1. The controlled environment is provided by a special air conditioning and humidification system which has the capability of filtration of air pollutants and particles. Accurate data are provided on humidity, temperature, oxygen tension, sulfur dioxide concentration, particulate concentration, and carbon monoxide and carbon dioxide concentrations.
2. The protocols are designed to filter some of these constituents of the environment in a systematic fashion for weekly periods during the course of an approximately one-month hospitalization of patients with chronic obstructive lung disease.
3. The patients will receive a complete work-up including lung function testing, arterial blood gas analysis, chest x-ray, and electrocardiogram.
4. A double-blind method has been instituted for changing the environment.
5. The work capacity for each subject is being measured upon entry and repeatedly during the course of the hospitalization.

FINDINGS TO DATE: This year forty-one new patients with chronic obstructive lung disease were processed. In fourteen of the subjects a complete investigation was made of air pollution factors. In the remaining patients, analyses were made of work capability as well as the effects of altitude and other variables. Environmental and geographic factors will significantly lengthen the work career of many patients in spite of the fact that they may have a progressively debilitating disease; where lung disease is more stable normal working life spans may be achieved.

APPLICABILITY: In addition to providing general information about vocational rehabilitation opportunities for patients with chronic lung disease in the northeastern United States, this program will make it possible to advise patients individually as to the effects of their changing geographic location, rural or city environment, or other aspects of their environment.

003 Factors Influencing the Right Heart Failure of Patients with Chronic Pulmonary Disease and Their Influence on Work and Exercise Capacity

Principal Investigator:	Edward H. Bergofsky M.D.	
1976		
Status:	Continuing	
Dates:	January, 1970-December, 1975	
Cost:	Annual $31,040 RT Annual $8,740	Projected Total $120,000 RT % of Annual Total 28%
Annual Report Reference:	#14, Page 25, R-6	
1977		
Status:	**Completed**	
Dates:	**January, 1970-December, 1975**	
Cost:	**Annual $6,554** **RT Annual $3,476**	**Projected Total $163,000** **RT % of Annual Total 53%**
Annual Report Reference:	**#15, Page 17, R-6**	

OBJECTIVES: The study was designed to determine activities of daily living which aggravate pulmonary hypertension by studies in animal preparations as well as in man.

METHODOLOGY: The methods involved in this program utilized studies on a cellular basis in systemic and pulmonary vascular tissues of animals and of man obtained either at autopsy or at surgical procedures on the lung; such lungs were studied for the behavior and distribution of the mast cell under a variety of conditions, including stress, exercise, chronic obstructive lung disease and after treatment with various pharmacologic and humeral agents. Also utilized was the intact pulmonary circulation of larger animals such as the dog and the cat, in which it is possible to directly infuse the appropriate pharmacologic agent, in order to determine drug action and potential beneficial effects in lowering pulmonary arterial pressure. It is in this particular preparation that the effects of digitalis have been most studied and it is also in this preparation that researchers studied the effects of such agents as angiotensin, histamine, serotonin and epinephrine and norepinephrine. Also conducted was research on the ionic properties of vascular smooth muscle and its possible relationship to the important digitalis effect which we have observed.

FINDINGS TO DATE:

1. Cardiac glycosides had previously been found to raise pulmonary vascular resistance. The direct effects of ouabain on the contractility of the vascular smooth muscle was examined. This was done to investigate vasoconstriction response to acute alveolar hypoxia. Findings suggest that ouabain acts directly on the pulmonary vascular smooth muscle cells, possibly by causing a depolarization through the well-known effect on the Na+ –K+ exchange pump, or by increasing the availability of Ca++ for contraction.
2. Ouabain, then, may act to potentiate the pulmonary vasoconstrictor response to hypoxia through these two mechanisms acting in concert by (1) inhibiting the Na+ –K+ membrane exchange pump, depolarizing the cells and bringing them closer to their excitation threshold, and (2) making greater amounts of Ca++ available for the electrical-mechanical contractile process. This latter could occur from the direct action of ouabain on Ca++ stores, as discussed above, or as a result of the depolarization process itself. With respect to the latter possibility, depolarization or inhibition of the Na+ –K+ membrance pump has been shown to increase cellular permeability to Ca++ or to effect the direct release of Ca++ from membrane-bound Ca++ stores (BRIGGS and SHIBATA, 1966).
3. Finally, although there is no direct evidence that ouabain can cause vasoconstriction in man, the evidence presented here suggests an investigation of the effect of this drug in the arterial hypoxemia resulting from the failure, in certain clinical conditions, of the usual mechanism for making the proper pulmonary vascular adjustments in matching perfusion with ventilation (DAOUD et al., 1972).

APPLICABILITY: An analysis of the physiology, pharmacology and pathology of the pulmonary circulation, and the manner in which this circulation acts to produce congestive heart failure in patients with chronic lung disease has produced valuable information on prophylaxis and treatment programs based on changes in the ionic composition, and the use of pharmacologic blockers, in order for digitalis to be administered to support the right heart. The control of congestive heart failure in these patients will speed rehabilitation and maintain these individuals in a vocational setting for an extended period of time, in spite of the slow progression of their chronic lung disease.

004 Use of Periodic Lung Expansion for the Facilitation and Rehabilitation and Prevention of Hospitalization in Patients with Poliomyelitis, Quadriplegia, Kyphoscoliosis, Muscular Dystrophy and Other Neuromuscular Diseases

Principal Investigator:	Edward H. Bergofsky, M.D.	
1976		
Status:	Completed	
Dates:	July, 1969-July, 1974	
Cost:	Annual $1,460 RT Annual $460	Projected Total $90,000 RT % of Annual Total 32%
Annual Report Reference:	#14, Page 30, R-7	

OBJECTIVES:

1. To determine whether attempts at periodic lung expansion, either by exercise or by mechanical ventilators, will serve to prevent episodes of acute respiratory failure in paralysis, poliomyelitis, quadriplegia, and kyphoscoliosis;
2. to investigate the use of lung hyperinflation for the facilitation of rehabilitation and prevention of hospitalization in all patients in a rehabilitation setting regardless of whether they have neuromuscular or skeletal abnormalities of the thorax;
3. to design programs for patients with quadriplegia, kyphoscoliosis, and rapidly advancing amyotrophic lateral sclerosis who develop respiratory muscle paralysis and respiratory failure.

METHODOLOGY The lungs are inflated in various mechanical devices and pulmonary mechanics are measured before, during, and after inflation. With the data thus acquired, the number of inflations required to maintain the lungs in optimum condition and the degree of inflation is determined. Other means of inflating the lungs are being tested.

FINDINGS TO DATE Fourteen new patients with quadriplegia, nine new patients with kyphoscoliosis, five new patients with muscular dystrophy, and three new patients with amyotrophic lateral sclerosis have been included in the program this year. After being studied, the patients are placed on a program of regular teaching comprising the use of respiratory apparatus and are referred to appropriate agencies for assistance in obtaining and maintaining equipment. Each patient is followed on an extensive basis until the program produces stabilization of the patient's condition and is examined, thereafter, on either a regular or ad hoc basis. Research protocols have been established to determine the alterations in exercise tolerance induced by this respiratory program. The major technique utilized is the maximal oxygen uptake by treadmill exercises (i.e., in kyphoscoliotic patient groups).

APPLICABILITY Investigation of this potentially important method of preventing acute or chronic pulmonary complications in paralyzed patients should result in preventive measures which will enhance the well being and productivity of such patients.

005 Functional Skills Remediation in Hemiplegia: Assessment Model for Eye-Hand Skills

Principal Investigator	Leonard Diller, Ph.D.	
1976		
Status	Continuing	
Dates	August, 1971-September, 1975	
Cost	Annual $54,880 RT Annual $16,330	Projected Total $200,000 RT % of Annual Total 30%
Annual Report Reference	#14, Page 34, R-10	
1977		
Status:	**Completed**	
Dates:	**August, 1971-September, 1975**	
Cost:	**Annual 0** **RT Annual 0**	**Projected Total $178,000** **RT % of Annual Total 0**
Annual Report Reference:	**#15, Page 23, R-10**	

OBJECTIVES

1. To develop a compact, scaled eye-hand dexterity battery for diagnosis and systematic remediation training in finger-hand dexterity.
2. To develop a compact scaled tactile-kinesthetic-spatial integration task (multi-directional peg board task) for diagnosis and systematic remediation of spatial kinesthetic dysfunctioning.
3. In order to have a wide replication throughout the entire developmental range (children to older adults) and for the most severely and only minimally impaired populations alike these test batteries will be constructed to:
   a. Be free of complex verbal instructions.
   b. To only include psychomotor tasks which can be executed with one hand.
   c. To have a wide range of difficulty.
   d. To incorporate the principles of competence and cuing.

METHODOLOGY

1. Norms are obtained.
2. Baseline measurements are obtained from brain-damaged subjects.
3. Small groups of normals carry out a series of cross validation studies in training on the proposed scaled tasks. The remediations are explored.
4. A controlled experiment is conducted on the effects of training on the combined three-scaled tasks.

Purposes

A. To determine the efficiency of combined training on BD. PUR and Multi-directional tasks on selected criterion measures.

B. To compare the effect over time of systematic training in eye-hand skills with routine occupational therapy.

Subjects: Forty-one left hemiplegics (17 experimental and 24 controls) and thirty nine right hemiplegics (23 experimental and 16 controls) were seen in this study.

Procedures: Training will be given for unaffected hand only. The order of training will be uniform: BD followed by Purdue and multi-directional scales. Distribution of total training time for each of the three modules to be determined according to results from phase three of the study.

The brain damaged subjects were administered the following tests: a) WAIS Similarities, b) WAIS Picture Completion, c) WAIS Object Assembly, and d) a set of criterion measures hypothesized to be sensitive to our treatment procedures: Purdue Pegboard Assembly, a standardized buttoning task, a standardized typing task, and a series of dexterity measures developed by Jepsom (Jepsom, et al., 1974) in addition to the specific training tasks.

FINDINGS TO DATE:

1. Phases 1, 2, and 3 have been completed and phase 4 has been started.
2. A total of 75 normals with both high and low socio-economic status have been tested, regarding the difference between right- and left-hand performances with respect to the variables of age, sex, and socio-economic status. Results suggest that age is a factor.
3. One hundred and two brain damaged patients (48 with left cerebral infarction and 54 with right cerebral infarction) were examined and compared to the normals. The eye-hand dexterity scale and multi-directional peg board tasks were used.
4. A study of 25 patients showed that the original procedures for measuring typing and buttoning skills had too low a ceiling for one-third of our patients but the variables derived from these tasks were relevant.
5. A series of factor analyses were conducted to establish the factor structure of the psychometric battery for normals and for patients with cerebral infarction. The factors which emerged paralleled the various specific tasks in the battery.
6. A similar analysis was done on the neurologic measures. Five neurological variables were found to meet the multiple criteria of ordinal scalability, patient discrimination, and consistency of usage: degree of unilaterality of damage and the resultant impairment of visual yields, joint position sense, response to stimulation by pins and motor function.
7. It has been found also that the neurologic and psychometric domains are lawfully and quantitatively related and that different variables of each measurement domain predict different aspects of the other domain.
8. Analysis of Covariance were carried out on 37 of the 39 scored variables as previously elaborated. In each case the independent classifying variable was patient group (Experimental or Control) and the data from the pre-training test session served as the covariant for analyzing the results of the post training sessions. The two remaining variables were the time measures on the two Buttoning tasks. There was a ten-minute time limit and the patients were stopped if the task was not completed within this limit. Non-parametric statistics were used on these measures to account for the indeterminate time scores of patients who did not complete the task within the limit. The post training performance of both the LH and the RH Experimental groups was significantly different from that of the Control groups on two of the three tasks in the Primary Criteria group (those tasks in which the Experimental groups received training), Purdue Pegboard and Block Design. In addition there were significant differences on various scored parts of the third training task, Multi-Directional Peg Board. On this last task, in comparison to the LH Control group, the LH Experimental group made significantly fewer rotation errors with eyes opened and closed, and significantly fewer space errors with eyes opened. The RH Experimental group made significantly fewer space errors with eyes opened and closed.
9. In the group of Secondary Criteria variables (other psychometric measures to which training could be expected to generalize) there were significant results on some of the same and on some different tasks for the LH and RH patient groups. Both groups improved significantly on the Purdue-like, Assembly task, The LH group also improved significantly in both the accuracy and time measures of the second and more demanding, Cancellation task, and in various quantitative measures of the Bender task as administered. The RH group improved significantly in only the accuracy measure of the second Cancellation task. Neither group improved in either the WAIS Object Assembly or WAIS Similarities tasks. This latter test was not expected to show movement and was instituted as a control task.

10. Some variables of the Tetiary Criteria group (real life examplars of skills involved in the training tasks) also showed significant differences between Experimental and Control groups. The LH group showed no differences on the accuracy measures of the Buttoning tasks, or on any of the Jebsen tasks, however, there were significant changes on the time measures of one of the tasks and on some of the scored variables in the typing task. The RH group manifested significant differences on an accuracy measure of one of the Buttoning tasks and the time measures of both Buttoning tasks. In addition there were significant improvements on two of the Jebsen measures and two of the typing variables as well.

11. An additional analysis was carried out consisting of t-test between all LH patients and all RH patients (Experimental and Control combined) on all pre-training test data. Significant differences were found for several variables.

APPLICABILITY: Development of this test battery will aid in retraining eye-hand skills in brain-damaged patients: currently a major lack in rehabilitation efforts. The battery will be clinically useful in diagnosis, prediction, and treatment and should have heuristic value in examining other issues in motor skills relevant to both abnormal and normal development.

006 Remediation of Untreated Impairments

Principal Investigator	Leonard Diller, Ph.D.	
1976		
Status	Continuing	
Dates	August, 1971-September, 1975	
Cost	Annual $69,780 RT Annual $8,280	Projected Total $240,000 RT % of Annual Total 12%
Annual Report Reference	#14, Page 44, R-13	
1977		
Status:	**Completed**	
Dates:	**August, 1971-September, 1975**	
Cost:	**Annual 0** **RT Annual 0**	**Projected Total $250,000** **RT % of Annual Total 0**
Annual Report Reference:	**#15, Page 34, R-13**	

OBJECTIVES: To test the efficiency of a method for treating a number of impairments which are commonly ignored in the rehabilitation of hemiplegics and other brain injured people: a) reading, writing and calculation; b) spatial organization and sensory awareness; c) eye contact; d) extended practice in visual scanning.

METHODOLOGY: To optimize a patient's potential for employment by training him in as many areas as possible, anticipating that reading, writing, calculation will be the most consuming skills to train. Training first in the eye contact and sensory areas, then in the area of academic skills. In an initial pilot study (N = 6) training in eye contact and sensory awareness will be counterbalanced in order to determine the effect of one upon the other. Each patient will receive training in gazing or sensory spatial first, then training in the other area. After an S has been trained to criteria in these domains he will be trained in academic skills. Before and after each training procedure Ss will be pre- and post-tested on the tasks standardized in the first phase of this study, as well as on the criteria tasks for academic skills.

FINDINGS TO DATE: The experimentals improved on all tasks except visual confrontation. Thus, they improve on 17 of 18 tasks ($p = .001$). In contrast, the controls improved on only 3 (Picture Completion, DSS, Lines Right). Inspection of the magnitude of the change on each of these tasks reveals that on each the significance of the improvement on the E's was greater than that found in the C's. Direct comparison of the two groups revealed that the groups began equally on 15 of the 18 tasks. On three (Object Assembly, DSS, and Impersistence) the C's exceeded the E's. Following treatment the E's were superior to the C's on 10 (WRAT, Paragraph, Arithmetic, Copying, Cancellation H, Cancellation C&D, Counting Faces, Matching Faces, Picture Completion, and Impersistence) of 18 tasks. Interestingly on the three tasks on which the C's were initially better than the E's the two groups were equivalent following treatment.

APPLICABILITY: In the literature there are countless articles reporting the various types of visual-spatial difficulties which are manifest in brain damaged individuals. While these problems are well enunciated they go untreated either because the patient is not aware of his perceptual difficulties or the attending physician is not aware that these problems are amenable to treatment.

007 Sequential Circulatory Assist

Principal Investigator:	Boguslav H. Fischer, M.D.	
1976		
Status:	Continuing	
Dates:	July, 1970-December, 1975	
Cost:	Annual $2,465 RT Annual $1,265	Projected Total $13,000 RT % of Annual Total 51%
Annual Report Reference:	#14, Page 80, R-26	
1977		
Status:	**Completed**	
Dates:	**July, 1970-December, 1975**	
Cost:	**Annual $1,273** **RT Annual $360**	**Projected Total $16,000** **RT % of Annual Total 28%**
Annual Report Reference:	**#15, Page 53, R-26**	

OBJECTIVES: Construction of suitable chambers enclosing the lower extremities. Design and construction of an air-pump and timing device permitting intermittent inflation of the chambers to predetermined pressures for variable periods of time. Determination of optimal timing of the cycle. Determination of patient's comfort and physiological response.

METHODOLOGY: The design and construction of the equipment will need interdisciplinary approach, i.e. specialists from the industry will be consulted and their advice incorporated with clinical approach. Patients will be selected from the New York University Medical Center. Each patient will serve as his own control since only one leg will be submitted to intermittent compression. Examination for the presence of thrombophlebitis will be performed on day one, four, and 10, comparing both extremities. Whenever possible, the I-125 fibrinogen method will be applied.

FINDINGS TO DATE: One-chamber legging enclosing the leg including the foot was found to adequately evacuate the venous blood and prevent any pooling. The legging was constructed from different material: vinyl and polyurethane. Vinyl, though less flexible, proved to be the better material since it is very easy to repair in case of an accidental puncture or minor leaking defect. Intermittent pressure was achieved in the range of 40 mm Hg by means of a two-way air-pump governed by a time programmer. The inflation time was 8 seconds followed by constant pressure of 40 mm Hg for 5 seconds, followed by rapid decompression within next 4 seconds.

The following disadvantages were found:

1. The noise was annoying and very irritating to the patient, despite of thorough noise suppression of the pump system.
2. Excessive sweating of the leg despite of internal lining of the legging with cotton towels. The sweating occurred usually toward the end of the second hour causing itching and discomfort. In addition, the danger of a skin break-down due to maceration of the skin must be taken into account.
3. The patient is practically arrested in bed with severe restriction of free body movements. This creates a very real danger of pressure sores.

The method obviously has its merits in reducing or even preventing the occurrence of thrombophlebitis. Unfortunately, the side effects and discomfort suffered by the patient are of such magnitude that other ways to solve the problem must be searched for.

APPLICABILITY: The rehabilitation of a patient is frequently stalled or even jeopardized by the occurrence of thrombophlebitis resulting in prolonged hospital stay and loss of priceless time. A method which could prevent the occurrence of thrombophlebitis will significantly contribute to the patient's safety permitting early mobilization and start of rehabilitation treatment. It will result in shortened hospital stay, earlier ambulation, and reduction of over-all hospital costs.

008 Variable Inclination Mattress

Principal Investigator	Boguslav H. Fischer, M.D.	
1976		
Status	Continuing	
Dates	July, 1970-December, 1975	
Cost	Annual $5,605 RT Annual $1,955	Projected Total $30,000 RT % of Annual Total 35%
Annual Report Reference	#15, Page 92, R-29	
1977		
Status:	**Completed**	
Dates:	**July, 1970-December, 1975**	
Cost:	**Annual $6,038** **RT Annual $541**	**Projected Total $28,000** **RT % of Annual Total 9%**
Annual Report Reference:	**#15, Page 62, R-29**	

OBJECTIVES:

1. Construction of an inflatable body support with an intermittent total relief of any pressure in critical areas of the sacrum and heels.
2. Construction of a ventilating system removing any excess of condensed water on the patient's body in critical areas.
3. Construction of an inflation system capable of inflating the mattress within specified time including maintenance of pressure and rapid deflation.
4. Construction of timing device with variable set points for inflation and deflation.
5. Special consideration to be given to noise suppression to a level never exceeding 15 decibels.

METHODOLOGY:

1. The equipment will consist of the body support proper, an air pump and timing device serving as master-control unit.
2. The center part of the body support has a horse-shoe cut out exposing the sacrum.
3. An inflatable wedge-shaped unit is placed under the calves of the patient.
4. During inflation cycle the entire body is lifted 6 inches high totally exposing the sacrum which can be easily reached and touched with hand. The body rests in the middle and upper part of the torso and along the midline of each thigh. At the same time the wedge shaped unit lifts the legs totally exposing the heels. The entire unit deflates uniformly after predetermined time allowing the body to rest along its entire length on the mattress.
5. Total relief of any pressure is achieved every fifteen minutes. During the steady inflated state warm air is pumped in the sacral area to remove any excess of condensed water thus eliminating the danger of skin maceration.
6. The second stage of this development involves intermittent elevation of the upper part of the body to semi-sitting position. This would actively support the ventilatory system with possible prevention of hypostatic pneumonia.

FINDINGS TO DATE:

1. A polyurethane body support system was constructed consisting of three parts, bound together by means of Velcro strips.

   The reason the entire mattress was divided into three sub-components was dicated by ease of repair in case of a puncture or a major leak. Instead of discarding the entire mattress only the damaged section needs to be replaced.
2. A pressure equalizer was constructed in order to assure a uniform inflation of all three segments of the body-support.
3. Two inflation systems were constructed, each equipped with a timing device permitting variable inflation and deflation time-settings.
4. Volunteer tests have shown the feasibility of this approach. Assuring full comfort of the patient there was total pressure relief over the sacrum and both heels.
5. In addition, the presence of the horse-shoe cut out significantly eases perianal hygiene since it becomes very accessible.

6. The construction of disposable paper basins lining the horse-shoe cut out is in progress. It will considerably increase the ease of hygiene in critical area.
7. Noise is a major problem at this time. Work is in progress to limit the noise level to a maximum of 15 decibels.

APPLICABILITY: Successful construction of an effective body support system has immense applicability in practically all hospitals, nursing homes and even private homes. Due to its low cost it will not present a major financial strain. The results will be presented during lectures, seminars, and post-graduate courses.

009 Antithrombin III in Ischemic Thrombotic Vascular Disease

Principal Investigator:	Robert H. Yue, Ph.D.	
1976		
Status:	Completed	
Dates:	January, 1971-April, 1975	
Cost:	Annual $22,585 RT Annual $4,485	Projected Total $90,000 RT % of Annual Total 20%
Annual Report Reference:	#14, Page 105, R-32	

OBJECTIVES:

1. To evaluate the antithrombin III level and rate of inactivation of thrombin by antithrombin in the plasma of high risk subjects;
2. to study the effect of polyvalent ions and small organic molecules on the rate of inactivation of thrombin by antithrombin III;
3. to study the relationship of heparin cofactor and antithrombin III at the molecular level through direct binding experiments;
4. to investigate the molecular structure both chemically and physically.

METHODOLOGY:

1. The amount of antithrombin III, the rate of inactivation, and the amount of thrombin remaining are determined in plasma from healthy and high risk subjects.
2. Polyvalent ions and small organic molecules are added to the reaction system and the rate of reaction recorded.

FINDINGS TO DATE: The antithrombin III values of 29 random samples of plasma were determined by the new rivanol method and the results are compared with the assay procedure previously developed. This new rivanol assay has also been applied to 48 patients with chronic ischemic heart disease under heparin therapy. The mean antithrombin III value was essentially identical to the mean antithrombin III value for a similar group of patients without heparin treatment. Hence, a minute trace of heparin in the plasma sample does not seem to affect this assay.

APPLICABILITY: Information from this study on the control of the ionic and metabolic balance of the circulating blood will be useful in choosing or developing appropriate anticoagulate therapy for the patient with ischemic thrombotic vascular disease. The use of such therapy may contribute to earlier ambulation of such patients, thus shortening this hospital stay.

010 The Hypercoagulable State in Thrombotic Disease (Formerly — Identification of the Stroke Prone Individual in the Covert State)

Principal Investigator:	Menard M. Gertler, M.D.	
1976		
Status:	Completed	
Dates:	September, 1965-June, 1975	
Cost:	Annual $17,757 RT Annual $3,757	Projected Total $150,000 RT % of Annual Total 21%
Annual Report Reference:	#14, Page 119, R-38	

OBJECTIVE: To use blood coagulation tests to identify a more precise time of the overt event of ITCVD (ischemic thrombotic cerebrovascular disease) so that early and more precise prevention therapy may be instituted.

METHODOLOGY: High risk individuals for ITCVD and IHD are selected and assessed periodically for parameters indicating the hypercoagulable state.

FINDINGS TO DATE:

1. During the past year a discriminant function analysis of risk factors has been developed in this laboratory for the detection of high risk individuals prone to develop ITCVD.
2. During the last year the biochemical, physical, and coagulation profiles have been developed, evaluated, and analyzed in the following groups: healthy low risk ITCVD group (48 subjects), healthy high risk ITCVD group (26), and chronic ITCVD group (36).
3. The present data points to a new concept in primary and secondary prevention of ITCVD. The concept embodies a continuum of various genetic and environmental patterns which, when combined with the factor of age, forms a realistic hypothesis which may be transcribed into scientific terms. Thus the covert stage of the disease may be recognized in the putatively healthy individuals by the clinical assessment of these parameters known as risk factors. This allows for intervention therapy. A similar assessment of risk factors may be made on individuals who have already experienced ITCVD.

APPLICABILITY: Greater understanding of the disease process involved in ITCVD and IHD should promote more precise prediction of the acute event and make possible primary and secondary preventive rehabilitation programs.

011 Ischemic Cerebrovascular Disease Study

Principal Investigator:	Menard M. Gertler, M.D.	
1976		
Status:	Completed	
Dates:	January, 1965-June, 1975	
Cost:	Annual $25,568 RT Annual $5,368	Projected Total $300,000 RT % of Annual Total 21%
Annual Report Reference:	#14, Page 131, R-39	

OBJECTIVE: To select individuals highly prone to thrombotic cerebrovascular attacks by use of the known risk factors of the disorders.

METHODOLOGY:

1. The basic design of the study requires a data base of male ITCVD (ischemic thrombotic cerebrovascular disease) subjects and similar age-matched controls. Each subject is on a normal diet, ambulatory, and undergoing active rehabilitation.
2. Measurements include fasting serum total cholesterol, lipid phosphorus, triglycerides, uric acid, complete blood count, blood urea nitrogen, electrolytes, thyroxine and liver profile. Three hour oral glucose tolerance tests are administered to all ITCVD and control subjects. Immunoreactive insulin (IRI), free fatty acid (FFA), and lactate levels are determined.

FINDINGS TO DATE:

1. During the past year, 72 males non-prone to ITCVD (mean age 55 years) and 67 males prone to ITCVD (mean age 55 years) have been classified by the application of the discriminant function analysis and are being followed at regular intervals. The screening of healthy individuals within the age range of 40-65 years who might be incubating covert ITCVD continues in order to detect risk factors of ITCVD and prevent or forestall the acute thrombotic event.
2. The following two study groups were analyzed: 18 ITCVD males with normal oral glucose tolerance tests (OGTT) and 39 age matched healthy controls with normal OGTT; 43 ITCVD males with abnormal OGTT and 21 age-matched healthy controls with abnormal OGTT.
3. The data shows a preponderance of abnormal OGTT and abnormal lipoprotein patterns in ITCVD as opposed to controls.

APPLICABILITY: The interdisciplinary approach to assessment utilized in this study can be used in community or industrial mass screening programs to detect seemingly healthy stroke-prone individuals who should be entered into an active preventive rehabilitation program. In the rehabilitation setting, this method will aid in detection of metabolic diseases which, when undetected and untreated, could delay and prolong rehabilitation and render the patient vulnerable to recurrent episodes of acute ITCVD.

012 Structure and Function of Factor X

Principal Investigator:	Robert H. Yue, Ph.D.	
1976		
Status:	Completed	
Dates:	January, 1971-January, 1975	
Cost:	Annual $13,380 RT Annual $1,380	Projected Total $98,000 RT % of Annual Total 10%
Annual Report Reference:	#14, Page 139, R-42	

OBJECTIVES:

1. To study the binding of calcium ion to Factor X and Xa;
2. to prepare Factor Xa by activating Factor X with Russell's viper venom;
3. to elucidate the physical and chemical properties of Factor X.

METHODOLOGY:

1. The rapid dialysis rate technique of Womack and Colowick using calcium-45 is used to study binding of calcium ions with Factor X and Factor Xa.
2. Factor X and Factor Xa are isolated.
3. The extinction coefficient, sedimenting properties, molecular weight, amino acid analysis, and sugar analysis of Factor Xa are determined.

FINDINGS TO DATE:

1. Titration of Factor X with Ca^{+2} Ma^{+2} or Ba^{+2} employing the technique of fluorescence quenching revealed that these divalent metal ions could bind Factor X.
2. The results suggest that complexation of metal ions with Factor X is a prerequisite in the activation process. Higher concentration of these metal ions may further modify the structure of Factor X through direct binding which results in partial inhibition of the conversion.

APPLICABILITY: Basic knowledge of the structure and function of Factor X will help to clarify the basis of ischemic vascular diseases. Better clinical assays can then be developed to improve the management and rehabilitation of these patients.

013 Driver Education and Research Project

Principal Investigator:	**Jack M. Hofkosh, M.S.**	
1977		
Status:	**Completed**	
Dates:	**March, 1965-March, 1976**	
Cost:	**Annual $19,933** **RT Annual $7,411**	**Projected Total $206,000** **RT % of Annual Total 37%**
Annual Report Reference:	**#15, Page 98, R-54**	

OBJECTIVES:

1. Assess feasibility of automobile driving for the spinal cord patient with neurologic deficit above the C5 level.
    a. Research the present electric device areas for existing equipment that would be acceptable for control adaptations for unusual patients.
    b. Evaluate the process and devices which allow patient access to and from the automobile.
    c. Evaluate present training techniques to assess validity in application to high level quadriplegic patients.
2. Assess the validity and productiveness of the past ten years of the driving education program with spinal cord injured patients below the C5 level with objective questionnaires.

3. Develop the assessment procedures, i.e., paper-and-pencil, motor coordination, and verbal tests, appropriate for the extra-driving assessment of the driving capabilities of brain-damaged individuals.

METHODOLOGY:

1. Evaluating the process of and the testing of devices which allow patient and wheelchair easy access to and from car.
2. Evaluation on the man-wheel interface. The unique problem of each patient requires a careful analysis and the coordinated development of such devices to accomplish these needs.
3. Control adaptations are at times necessary to accommodate the individual patient. This must be evaluated, needs ascertained and adjustment made.
4. Evaluation of the driving potential of brain-damaged individuals. These brain-damaged individuals are composed of the traumatic brain injured, CVA post-stroke, and congenitally brain injured. The evaluation process consists of testing and improving existing assessment procedures, and attempting to develop valid tests for administration outside the actual driving situation.

FINDINGS TO DATE:

1. Tests designed to the IRM-TCS Driver Education Research Program to evaluate brain damaged patients indicate that the series of figure eight maneuvers is a useful aid in detecting inadequate scanning and planning on the part of some of the disabled patients.
2. A new wheel spinner for the amputee driver has been designed. The improved safety design provides more positive contact with the steering wheel at all times.
3. Modification of a steering cuff for C5-6 quadriplegics enabled some patients to turn the steering wheel successfully after the inserting pin has been rotated 90° to the back of the patient's hand. Research continues in this area to devise a universal cuff that would adjust to most situations without compromising safety and efficiency.

APPLICABILITY: The previous knowledge attained from multiple years of on-the-job experience and research with patient interaction can now be easily utilized to promulgate Public Law 93-538 which will enable us to train driving instructors to teach physically disabled veterans. During the last twelve months we have had 2 four-day seminars. One was held in Washington with an attendance of 40 representatives of all Veterans Administration Centers throughout the United States. The second one was held at IRM with an attendance of 16 participants.

014 Electrocardiographic Monitoring with Telementry During Physical Therapy

Principal Investigator:	Masayoshi Itoh, M.D.	
1976		
Status:	Completed	
Dates:	March, 1969-June, 1975	
Cost:	Annual $9,710 RT Annual $2,760	Projected Total $60,000 RT % of Annual Total 28%
Annual Report Reference:	#14, Page 173, R-55	

OBJECTIVES:

1. To establish some dependable criteria which can regulate the amount of physical activity that can be safely administered to the high risk population of myocardial ischemia;
2. To test the hypothesis that telemetric electrocardiographic monitoring of patients during active physical therapy will be a useful method to minimize the chance of aggravation of cardiac complications and speed rehabilitation processes within a safe limit of cardiac activity.

METHODOLOGY:

1. All patients scheduled for physical therapy receive a complete comprehensive physical evaluation including chest x-ray and standard electrocardiography.
2. Dynamic telemetric electrocardiograms are taken as patients become ambulatory and subjective symptoms are noted.
3. This test is repeated whenever necessary and increase or decrease of cardiac tolerance is evaluated.

FINDINGS TO DATE: Nine new patients were referred to physical therapy for dynamic electrocardiogram testing and followup. Four patients were hemiplegics; three had spinal cord injuries or degenerative diseases; two had miscellaneous diagnoses without physical disability (but had history of cardiac disease). Eight of the patients had a history of cardiac disease. There are now 137 patients in the study. Patients from the intensive care unit are needed.

APPLICABILITY: Application of physiological monitoring during a physical therapy program provides the physiatrist and therapist with immediate data regarding the patients' cardiac response to the activity. This procedure can provide more rapid and accurate assessment of patients' capacities and allows for a more individualized prescription of physical therapy.

015 Objective Evaluation of Lower Limb Blood Flow and Circulatory Reflexes in Patients with Advanced Arteriosclerosis Obliterans

Principal Investigator:	Theobald Reich, M.D.	
1976		
Status:	Continuing	
Dates:	September, 1970-September, 1975	
Cost:	Annual $7,305 RT Annual $3,105	Projected Total $55,000 RT % of Annual Total 43%
Annual Report Reference:	#15, Page 204, R-65	
1977		
Status:	**Completed**	
Dates:	**Sept., 1970-Sept., 1975**	
Cost:	**Annual 0** **RT Annual 0**	**Projected Total $58,000** **RT % of Annual Total 0**
Annual Report Reference:	**#15, Page 125, R-65**	

OBJECTIVE: To evaluate the peripheral circulation in the lower limbs of patients with advanced arteriosclerosis obliterans by objective means in order to study the effects of alleviating arterial insufficiency.

METHODOLOGY:

1. Patient with severe arterial insufficiency or arteriosclerosis obliterans had calf blood flow determined by venous occlusion plethysmography using a mercury-in-rubber strain gauge while.
    A. The patient was in the supine position at rest;
    B. following a period of exercise on an ergometer in the supine position until claudication developed;
    C. following the same procedure as #1 but with the upper extremity placed in cold packs to produce reflex vasoconstriction in the lower extremities.
2. These tests procedures were repeated at two week intervals while the patient received meticulous foot care and conventional care to reduce the hazards of ischemic injury to the lower limbs. In view of the beneficial effects that were noted with large doses of Cyclandalate, a double blind cross-over study was conducted using Cyclandalate and placebo. The dose of Cyclandalate was 400 mg given four times a day.

FINDINGS TO DATE:

1. Objective quantitation or calf blood flow in patients with intermittent claudication revealed that some patients with reasonably good walking ability had dangerously low blood flow values whereas other patients with poor walking ability had reasonably good blood flow values. Thus, the assessment of a patient's circulation to his lower limbs based on his own subjective appraisal of his walking ability may be seriously erroneous.
2. In another aspect of the study, 39 patients with arterial insufficiency were treated with Cyclandalate and placebo in a double blind cross-over study to evaluate the effect of this drug and symptomalogic and physiologic parameters of the circulation. The parameters evaluated were skin termperature of the toe and foot, blood flow at rest, blood flow immediately after exercise until the onset of claudication, patient assessed walking distance to claudication, and reflex vasoconstriction of the skin of the toes and foot due to cooling of the upper extremities. Each

parameter was evaluated, and analyzed statistically. Following Cyclandalate, most parameters improved significantly. Of particular interest was the improvement noted in the reduction of reflex vasoconstriction due to cold and a small, but improved, ability to walk before the onset of claudication.

APPLICABILITY: Amputation of the lower limb imposes severe disability the magnitude of which reaches calamitous proportions in feeble geriatric patients and when amputation is bilateral. Rehabilitation of such patients is difficult because of their advanced age, poor coordination, and frequent arterial insufficiency and other vascular beds. Delay or even avoidance of amputation is, therefore, an important objective.

016 Correlative Kinesiology

Principal Investigator	Erwin R. Tichauer, Sc.D.	
1976		
Status	Continuing	
Dates	September, 1967 December, 1975	
Cost	Annual $73,140	Projected Total $327,700
	RT Annual $22,563	RT % of Annual Total 31%
Annual Report Reference	#14, Page 214, R-74	
1977		
Status:	**Completed**	
Dates:	**September, 1967-December, 1975**	
Cost:	**Annual $34,375**	**Projected Total $456,000**
	RT Annual $17,439	**RT % of Annual Total 51%**
Annual Report Reference:	**#15, Page 129, R-74**	

OBJECTIVES: The main objective of this project resided in the identification of those vectors in the working and activities of daily living environment of rehabilitees which interfere with an individual's ability to be self-sufficient and self-supporting. A second aim was the development of procedures suitable for the objective evaluation of residual motor aptitudes and trainability for occupational situations for special working populations, such as the severely disabled, the aged, women entering industry, and workers who have to be re-trained because of technological obsolescence of their skills or changes in their work habits, such as in the case of those who have suffered cerebrovasular and cardiovasular accidents.

METHODOLOGY: Specific studies during the course of this project, all employing equipment based upon the principles outlined above, included:

1. Investigation of the kinesiology and biodynamics of lifting and materials handling tasks in seated and standing work situations.
2. Instrumentation of commonly used industrial hand tools with strain gauges and potentiometers for the purpose of relating work accomplished to the effort required to complete the task. By these techniques, it was possible to assess the relative efficiency of different tools and the biomechanical compatibility of tools and the disabled worker.
3. Development of the technology and methods necessary to critically evaluate the biomechanics of visual perception, eye-hand coordination, and manual skills in microscope inspection and assembly work.
4. Preliminary construction and evaluation of a simple apparatus to permit the objective characterization of muscle fatigue in work demanding rotational motion of the forearm.
5. Study of the effects of intermittent occupational noise on the precision and speed of unguided hand movement performance.

FINDINGS TO DATE:

1. It was shown that a difference of a few inches in workplace height during materials handling may create or alleviate a potential lifting hazard, and can mean the difference between an easily handled job or a severe lifting task beyond the capabilities of a disabled worker. The criteria were pertinent to the capabilities of a disabled worker to perform light materials handling tasks in safety and without risk to others in a competitive working environment. The results of the project are likely to expand the employment possibilities for the disabled, and to provide standards and guidelines for safe workplace layouts which will benefit both healthy and disabled workers.

2. It was found that, although time of performance did not increase significantly, the number of errors increased with increased intermittent occupational noise levels. The investigation provided results on manipulative skills of subjects which can be interpreted to mean that intermittent occupational noise does negatively affect precision of unguided hand movement.

APPLICABILITY: The knowledge gained from this project enables potential employers, as well as vocational rehabilitation units, to measure and evaluate the residual motions inventory of the disabled, and to describe it in terms of standard elements of work known to industry. On the basis of this, changes in task design and work pattern may be effected which, while not improving the medical disability, will nevertheless substantially reduce the resulting vocational impairment. Furthermore, the specialized procedures for electromyographic kinesiology developed in the course of this project focus attention upon the specific needs and attitudes of the disabled worker.

017 Temporal Factors in Recovery from Aphasia

Principal Investigator:	Martha Taylor Sarno, M.A.	
1976		
Status:	Completed	
Dates:	October, 1974-February, 1976	
Cost:	Annual $20,895 RT Annual $19,895	Projected Total $37,000 RT % of Annual Total 95%
Annual Report Reference:	#15, Page 153, R-83	

OBJECTIVES: The purpose of this investigation was to determine the recovery characteristics of post-stroke aphasic patients who received speech therapy, with particular reference to recovery levels at specific points in time. The study was particularly concerned with those patients who had gone beyond the so-called "spontaneous recovery" period, that is, those who were at least three months post-stroke. The study was intended to document the changes which occurred in various aspects of communication effectiveness at pre-determined intervals following the onset of aphasia. The results were analyzed in an attempt to determine:

1. The most efficacious time to initiate therapy
2. The optimal time for continuation of therapy
3. The optimal recovery goals for different varieties of aphasia
4. Alternative methods of treatment or rehabilitation beyond speech therapy

METHODOLOGY:

1. The 111 patients who were selected for study were Caucasian, right-handed, literate, native speakers of English referred to the Speech Pathology Service for evaluation and treatment. All were post-stroke aphasics who received speech therapy.
2. The measures administered to all patients were 1. **The Functional Communication Profile** (FCP) (Taylor, 1965; Sarno, 1969) and 2. **The Neurosensory Center Comprehensive Examination for Aphasia** (NCCEA) (Benton, 1967). The FCP is a rating scale for aphasics which considers 45 communication behaviors of everyday life. Ratings of each behavior are made on an 8-point scale, based on observations of the patient during an informal conversation.

FINDINGS TO DATE:

1. Perhaps the most salient finding of the study is that during the time period between 12 and 16 weeks post-stroke 67% of the patients tested showed an actual **decrease** or less than five percent gain on **Overall Functional Communication Profile** Score. The same finding does not obtain to any other time interval in this study. This suggests that the aphasic patient might benefit from an increased emphasis on the psychological-supportive aspects of speech therapy during this time.
2. Another significant result of the present study suggests that certain language examinations for asphasia do not, in fact, indicate a patient's everyday communication effectiveness, that is, his functional **communication.** This finding suggests that the traditional practice of using language test scores as indicators of progress in aphasia rehabilitation is open to question. Indeed, the continuation and funding of speech therapy is often based on changed scores derived from aphasia tests.

APPLICABILITY: The information generated by this study will be of great usefulness to physiatrists, speech pathologists, vocational counselors, social workers, and other health workers concerned with the management of the patient with aphasia secondary to stroke. In addition, the information will be of particular interest and utility to certain programs that fund the care of aphasic patients.

018 Regulation Of Regional Intracerebral Circulation During Injury and Aging

Principal Investigator:	J. N. Barker, Ph.D.	
1976		
Status:	Continuing	
Dates:	September, 1966-December, 1976	
Cost:	Annual $17,625 RT Annual $8,625	Projected Total $240,000 RT % of Annual Total 49%
Annual Report Reference:	#14, Page 8, R-2	
1977		
Status:	**Continuing**	
Dates:	**September, 1966-December, 1976**	
Cost:	**Annual $18,310** **RT Annual $10,778**	**Projected Total $240,000** **RT % of Annual Total 59%**
Annual Report Reference:	**#15, Page 7, R-2**	

OBJECTIVES: Our objectives are to learn how to diagnose and correct slow brain blood flows in localized regions of the human brain.

METHODOLOGY: Xe-133 is utilized for in vivo measurements of regional and local cerebral blood flows; C-14 and H-3 antipyrine method, if rats or monkeys are sacrificed for truly local flow measurements. The stimulated fluorescence technique involves injection of non-diffusible contrast media, radiation of a minute volume of brain with an x ray source, and analysis of the fluorescence released thereby with a solid state detector system. The only volume seen is that included in the intersection of the beams from the radiation source and detector viewing area, the precise volume being set by collimation of the beams. It can be very small, of the order of a cubic millimeter. The ultrasonic procedures require only that a probe be placed on the skin over the carotid or other artery. The time for the sound return measures the arterial diameter while the shift in sound frequency measures velocity of flow. From these, flow in the vessel can be calculated. When it is desirable to know the size of the head as in early infancy to calculate brain volume, the biostereometric technique devised by Herron at the Texas Institute for Rehabilitation and Research will be used until a more simplified procedure is devised.

Subjects are aged rats, genetically hypertensive and hypotensive rat strains, and rhesus monkeys, with ultimate application to man in a concurrent project. Human brains are also being studied.

FINDINGS TO DATE:

1. Instrumentation has been completed to allow the measurements of blood flow rate through 144 small cubic subdivisions throughout the human brain.
2. Currently being studied are methods of restoring blood flow to local ischemic regions without harming non-ischemic regions.
3. The results of these studies and of those for monkeys reported last year have indicated the need for measurements of the dynamics of capillary remodelling after brain injury.
4. When animals were allowed to age, it was found that they suffered many of the same degenerative diseases (especially space-occupying lesions, e.g. pituitary adenomas) that afflict aged people.
5. It was found in sixteen rhesus monkeys undergoing long term recovery from chronic cerebrovascular insufficiency that half of them displayed a spontaneous slow brain blood flow in the first weeks after birth.
6. The main contribution of FY 1977 work is extention of last year's new concept concerning early influences upon brain microvasculature which may strongly influence the susceptibility to stroke and again in later life. As we have mentioned in earlier reports, there is no doubt that the microvasculature is significantly remodelled in response to hypertension, space-occupying lesions, and 'senile' degenerations in our animals. One may also find reports of such modifications for people due to aging, hypertension, brain tumor, hydrocephalus, and among mental retardates and cerebral palsy victims. Most often, these variations have been considered to be the consequence of the disease. Undoubtedly they often are, as we have shown. But we have not realized until last year that a very large fraction of the population, perhaps more than 30%, have been set upon a path to later stroke and senility very early in life.

APPLICABILITY: The product of this research is a new instrument and method for general purpose use in screening and diagnosis of cerebrovascular disorders, and a firm foundation of knowledge upon which to base improved therapies. It is anticipated that neuroradiologists will use this product to aid neurologists and neurosurgeons in planning their therapies, and that psychiatrists and geriatrists will use it for more precise selection of those with organic and correctable functional disorders, that preventive medicine personnel will utilize it for screening early changes at a time when they might still be reversible in high risk cases, that pediatricians will check to see if a large percentage of premature infants can be saved from brain impairment by restoration of blood flow in the early period after birth, that spinal cord centers will use it to attempt to limit residuals of cord injuries, and that rehabilitation centers will be provided with a population in which lesser severity of disabilities will permit more adequate performance by patients. Some years will obviously be required to achieve these potential benefits for the several million patients involved. Many of these diseases are more prevalent in minority groups.

019 Application of Ozone to Infected Wounds and Pressure Sores in the Management of Chronic and Acute Urinary Tract Infections

Principal Investigator:	Boguslav H. Fischer, M.D.	
1976		
Status:	Continuing	
Dates:	August, 1970-December, 1976	
Cost:	Annual $2,653 RT Annual $1,553	Projected Total $20,000 RT % of Annual Total 59%
Annual Report Reference:	#14, Page 68, R-23	
1977		
Status:	**Continuing**	
Dates:	**July, 1970-December, 1976**	
Cost:	**Annual $1,755** **RT Annual $790**	**Projected Total $20,000** **RT % of Annual Total 45%**
Annual Report Reference:	**#15, Page 48, R-23**	

OBJECTIVES:

1. Design and construction of a fool-proof ozone circuit permitting direct application of ozone to the infected area with total elimination of any danger to the patient and operating personnel.
2. Establishment of optimal ozone concentration necessary to actively arrest or annihilate any bacterial growth as well as the duration of action.
3. Efficient reduction of ozone concentration level at the exhaust circuit.

METHODOLOGY:

1. The instrumentation necessary for direct ozone application to infected wounds consists of:
    a. An ozone generator delivering necessary quantities of ozone in pre-selected concentrations,
    b. calibration instrument to actually measure the concentration of generated ozone,
    c. ozone applicator – either in form of a hermetic cup or as a chamber with hermetic enclosure,
    d. de-ozonizing unit reducing ozone to zero-level at the exhaust circuit.
2. Patients will be selected from the New York University Medical Center
3. The results will be monitored by photographic documentation, actual measurements of treated lesions and serial bacterial cultures during the course of treatment.
4. Additional studies will be performed on bacteria in vitro.

FINDINGS TO DATE:

1. Further progress was made in the design and construction of deozonizing units. The greatest obstacle, however, is the achievement of total hermeticity of the system preventing even a minute leak of ozone to the surrounding atmosphere. Ozone is an extremely toxic and dangerous substance with the greatest destructive action exerted on the respiratory system. Federal standards

permit the concentration of ozone in breathing air to a maximum of 0.05 ppm, though the concentration of ozone during sunny days may reach 0.5 ppm on the eastern seaboard. Deozonizing equipment creates back-pressure in the circuit further complicating the issue of hermeticity. The introduction of negative pressure suction apparatus reduced the back pressure to 2-3 mm Hg.

2. Two patients presented diabetic ulcerations of the lower extremities. One patient had a third degree burn of the left middle finger. In all cases a rapid clearing of the lesions with pronounced pink coloration was evident already after the first two treatments with ozone. This was followed by contraction of the ulcer with subsequent epithelium formation. Four lesions healed uneventfully within an average time of 14 days. One lesion, presenting a complication in form of an aggravated pressure sore of the sacrum due to faulty nursing technic was cleared within 5 days of ozone treatment to such an extent that surgical closure was performed without untoward reactions. The high drying effect of circulating ozone on ulcerations is a matter of concern since a humidification of at least 55 to 60% relative humidity is necessary to create optimal healing environment.

APPLICABILITY: The objectives of the project literally deal with the base of any vocational and rehabilitation effort since the prospective patient must first be cleared from any skin break-down and pressure sores before any rehabilitation process can start.

020 Topical Hyperbaric Oxygen Treatment of Pressure Sores and Certain Skin Ulcerations

Principal Investigator:	Boguslav H. Fischer, M.D.	
1976		
Status:	Continuing	
Dates:	July, 1971-December, 1976	
Cost:	Annual $7,120 RT Annual $3,220	Projected Total $40,000 RT % of Annual Total 45%
Annual Report Reference:	#14, Page 87, R-28	
1977		
Status:	**Continuing**	
Dates:	**July, 1971-December, 1976**	
Cost:	**Annual $12,056** **RT Annual $5,296**	**Projected Total $40,000** **RT % of Annual Total 44%**
Annual Report Reference:	**#15, Page 5, R-28**	

OBJECTIVES:

1. Development of a new type of pressure controlled sealing cuff which would eliminate accidental overinflating with resulting circulatory embarrassment.

   The cuff must have a direct read-out gauge indicating the actual pressure inside the cuff regardless of the pressure inside the chamber.
2. Development of a pulsating type of hyperbaric oxygen permitting the application of oxygen in pulsed way with pressure ranges from 0 to 50 mm Hg, and possibly from 0 to 75 mm Hg.

METHODOLOGY:

1. The problems involved in the construction of the pressure cuff and a pulsed hyperbaric oxygen chamber requires the cooperation of technologists in the engineering and material sciences and those who have clinical care of the patient.
2. Major help was received from companies like the Topox Corp., Emmerson Corp., International Paper Corp., Simmons Co., Dielectrics Co.
3. Patients will be selected from the New York University Hospital as well as from other hospitals which are equipped with proper instrumentation.
4. The progress of the therapy will be monitored by means of photographic documentation, actual measurements of the size of the treated lesions and serial bacterial cultures. In suitable cases the capillary p02 will be determined.
5. Patients who present intractable lesions of at least three months duration are the most favored ones for this type of treatment since they offer the best opportunity for proper documentation of the efficacy of this treatment modality.

6. Based on past experience the treatment seldom will exceed 4 weeks with daily oxygen exposure of four hours.

FINDINGS TO DATE:

1. Several models of an inflatable cuff were constructed and tested. It was found that an inflatable channel running around the sleeve may exert constricting pressure embarrassing the circulation. At this time experiments are in progress for an inflatable cuff with a semi-circumferential channel. This configuration promises to achieve a good sealing quality excluding any excess of pressure able to interrupt the circulation.
2. First trials were performed applying pulsed hyperbaric oxygen directly to the extremity. Patients tolerated very well pulsed pressure applied with a range of 0-30 mm Hg. Trials are in progress to increase the range to 50 mm Hg.
3. Special timing device was constructed using a remotely controlled solenoid valve. The solenoid valve is operated by means of two photocell sensors with direct read-out on the pressure gauge.

APPLICABILITY: Topical Hyperbaric Oxygen treatment presents a new tool to successfully shorten the hospital stay and treatment period of a patient.

Any rehabilitation program is effectively stalled by the occurrence of even one pressure sore or a skin break-down. Infected post-surgical wounds are a dreaded complication which prolongs hospital stay increasing the over-all hospital costs.

021 Zinc Sulphate in the Treatment of Various Skin Disorders

Principal Investigator:	Boguslav H. Fischer, M.D.	
1976		
Status:	Continuing	
Dates:	June, 1970-December, 1976	
Cost:	Annual $17,550 RT Annual $3,450	Projected Total $125,000 RT % of Annual Total 20%
Annual Report Reference:	#14, Page 96, R-30	
1977		
Status:	**Continuing**	
Dates:	**June, 1970-December, 1976**	
Cost:	**Annual $13,876** **RT Annual $4,471**	**Projected Total $106,000** **RT % of Annual Total 32%**
Annual Report Reference:	**#15, Page 66, R-30**	

OBJECTIVES: There is evidence that a major zinc loss occurs in any form of prolonged immobilization of the human body accompanied by muscular wastings. 60% of body zinc is stored in the muscular system.

Problems:

1. Rate of zinc loss in patients immobilized for prolonged periods of time.
2. Relation of plasma zinc levels to ulcerations of the skin.
3. Doses of zinc sulphate to be administered daily in order to maintain adequate zinc level in body tissue.
4. Action of zinc in acceleration of healing of existing skin break-downs.

METHODOLOGY:

1. Patients will be drawn from the New York University Medical Center including the Veteran's Administration Hospital. Blood samples will be drawn using stainless steel needles and all-glass syringes, immediately spun down and stored in frozen state in rubber-less containers.
2. Zinc determination will be performed using an atomic spectro-photometer.
3. Zinc concentration will be determined on a bi-weekly basis starting from the day of disability or injury, and conducted for at least six months.
4. Oral supplementation will be performed using Zinc sulphate in capsules, 200 mgm each, 600 mgm/day equaling 150 mgm of elementary zinc. This amount proved too sufficient to replenish zinc stores without untoward reactions, chiefly in form of gastro-intestinal irritation.

FINDINGS TO DATE:

1. Serial measurements were performed on 54 patients presenting paraplegia or quadriplegia with or without pressure sores as well as on two patients undergoing chronic cortico-steroid therapy. Sixty-three samples were collected and measured.
2. It was found that normal zinc levels were not necessarily related to the absence of chronic ulcerations.
3. There seems to be a pattern emerging in zinc concentrations in immobilized patients: There is a major zinc loss in the urinary tract during the first 2-3 months of immobilization with stable serum zinc levels; towards the end of the third month, the urinary excretion of zinc rapidly falls and becomes level at the average normal value but is accompanied by a major serum-zinc depression showing that the patient is becoming zinc deficient.
4. Oral supplementation of zinc sulfate brings a rise in serum level within 2-3 weeks with only slightly increased urinary excretion.
5. There were only two cases of mild gastric irritation in the form of nausea. This was alleviated by the ingestion of zinc-containing capsules during and not after the meal.
6. No adverse reactions were noted which could be attributed to zinc administration.
7. Six patients were monitored for zinc levels in their plasma. Meticulous criteria were applied to assure maximum freedom from contamination.
8. Time tables of blood drawings were established and the cooperation of various departments of the New York University Medical Center assured.

APPLICABILITY: Proper maintenance of the skin integrity is of fundamental importance for a full course of rehabilitation and vocational therapy.

022 Electrophysiological Studies in Neuromuscular Diseases

Principal Investigator:	Joseph Goodgold, M.D.	
1976		
Status:	Continuing	
Dates:	February, 1967-November, 1976	
Cost:	Annual $89,107 RT Annual $80,807	Projected Total $430,000 RT % of Annual Total 91%
Annual Report Reference:	#14, Page 148; R-48	
1977		
Status:	**Continuing**	
Dates:	**February, 1976-November, 1976**	
Cost:	**Annual $94,849** **RT Annual $73,168**	**Projected Total $580,000** **RT % of Annual Total 77%**
Annual Report Reference:	**#15, Page 74, R-48**	

OBJECTIVE: To determine whether the peripheral nerves are involved in the disease process of myotonia.

METHODOLOGY:

1. Denervate one side of laboratory animals.
2. Induce myotonia in these animals.
3. Record electromyographic activity and tension responses from innervated and denervated muscles.
4. Compare data from experimental and control animals to determine whether myotonia can be induced in denervated muscles.

FINDINGS TO DATE:

1. The frequency of spontaneous electrical activity was much greater in the denervated muscles of injected denervated muscles, insertion activity was prolonged over many seconds; percussion gave rise to a burst of potentials which was not observed in the control group with denervated muscles; occasional high-frequency bizarre discharges and, though infrequent, a few myotonic responses were recorded. Very few high-frequency bizarre discharges were found in the "non-injected" denervated musculature. As reported previously in myotonic animals, myotonic responses are frequently seen with slight movement of the electrode or after percussion.

2. The contractile response of "denervated" non-injected muscles to a series of tetanic stimulations resembled that of normally innervated muscles. The major difference of the two was the decreased shortening of the denervated muscles which is apparently due to denervation-induced atrophy. In a few of the denervated muscles, the relaxation phase did not immediately return to baseline but was prolonged for about one second.
3. The contractile response of denervated muscles of injected rats more clearly demonstrated the effect of diazacholesterol. The denervated muscles like the innervated muscles had a prolonged relaxation time which extended well over 5 seconds. This prolongation of the relaxation phase was observed in each of the injected muscles that were tested, both innervated and denervated.
4. The results of this study show that diazacholesterol can alter the electrical and mechanical properties of denervated muscles, and that the changes are characteristic of myotonia. Prolonged relaxation time of the muscle contraction, extended electrical activity following needle movement or percussion and occasional myotonic responses observed in the denervated muscles after treatment, support the conclusion that the nerve supply is not an essential prerequisite for inducing myotonia.

APPLICABILITY: The results of this investigation is significant to the clinician as well as the scientist. For the clinician our findings will aid in diagnosis of neuromuscular disease; for the scientist it represents a better understanding of the disease process. The results demonstrate that the nervous system is not involved in producing this disorder.

023 Work Classification of Patients with Obstructive Pulmonary Disease Following Rehabilitation

Principal Investigator:	Albert Haas, M.D.	
1976		
Status:	Continuing	
Dates:	January, 1970-December, 1976	
Cost:	Annual $24,550 RT Annual $12,650	Projected Total $115,000 RT % of Annual Total 52%
Annual Report Reference:	#14, Page 162, R-53	
1977		
Status:	**Other (request for extension)**	
Dates:	**January, 1970-December, 1977**	
Cost:	**Annual $42,895** **RT Annual $26,414**	**Projected Total $240,000** **RT % of Annual Total 62%**
Annual Report Reference:	**#15, Page 91, R-53**	

OBJECTIVES: This project will demonstrate that a comprehensive, well-planned rehabilitation program based on realistic and individualized patient goals can achieve signifi[illegible] and enduring effects. It will also demonstrate that a multi-disciplinary approach coordinated under one roof is indispensable to a successful rehabilitation effort. A dynamic rehabilitation plan will be constructed, indicating the step-by-step application of such a well-organized program. The study will also result in the development of work classification categories based on the following energy-cost fields: low, medium, high, heavy.

METHODOLOGY: Two groups of patients, experimental and control, have been selected for this study. Each group contains 125 patients with a ratio of 4 males to every female. The patients in both groups undergo a routine x-ray, clinical and laboratory evaluation, including pulmonary function testing by spirometry, plethysmography to measure airway resistance and compliance, and a determination of pulmonary diffusion capacity and blood gas determination both at rest and exercise. These tests constitute the baseline study necessary before starting the work classification study. The patients are then prescribed relaxation exercises, postural drainage, breathing exercises, and oxygen exercises. Once these therapeutic exercises have been learned, the patient is given varying work loads starting with a minimum of 300kgm/min. A three minute warmup period allowing the patient to reach or approximate a steady-state is followed by five minutes of exercise at a chosen work load. Laboratory procedures, based on energy-cost studies, are used to develop a reliable work classification for each patient. Before exercise as reference point, an analysis is made of oxygen consumption while sitting. During the exercises, as well as during the warm up period, minute-by-minute oxygen consumption heart rate and oxygen debt are measured to determine if and when the patient reaches his breaking point. Upon cessation of the exercise, heart rate and blood pressure are measured while sitting. A breath-by-breath analysis is made of the expired gas to determine the contracted oxygen debt and the time to recover from it. Blood gas analyses, such as oxygen tension saturation and CO_2 tension, PH and acid-base balance are monitored as well. The tolerated work load is translated into actual work activities in one of the different energy-cost fields, and these activities are then carried out in a workshop setting.

FINDINGS TO DATE: To date, 520 patients have been screened for this study. 96 males and 27 females (123 in total) have been chosen with the following results:

1. Basal metabolic rate before the reconditioning exercises ranged from + 14, and from + 5 after the reconditioning exercises.
2. The range of respiratory exchange ratio was 0.5 to 1.0 before reconditioning exercises, tending to stabilize at 0.7 to 0.8 after these exercises.
3. Patients reached a steady state while at rest but only approached it during exercises. After the reconditioning exercises the patient failed to reach a complete steady state, although the contracted oxygen debt became somewhat smaller and the rate of recovery was shorter. Duration and tolerance to the minimum workload exercises (of 400 kg meters/ minute increased by a ratio of 1:3. Similar results were observed when the patient did small assembly work in a sitting position. The heart rate in B.P. remained within normal limits during the appropriate exercises.

Preliminary analyses of the data collected on the 37 patients who have completed the project indicate that they tolerate well, maximum exercise from 300-500 kg/meters/minute work load. This is comparable to a low energy cost field and defines sedentary situations, e.g., clerical and small assembly work. 33 patients were placed in jobs from 8-20 months through the Department of Vocational Rehabilitation. 22 have successfully maintained their jobs. 4 patients relapsed and their rehabilitation evaluation has to be reviewed and replanned. 16 patients are in the middle of training in their respective trade or vocation.

APPLICABILITY: Patients with COPD are generally unable to return to and maintain steady employment because most of the present rehabilitation programs are not properly planned and vocational goals are inappropriately chosen. Successful vocational rehabilitation is contingent upon a reliable work classification to determine the occupational field in which the patient can successfully maintain a favorable status. These work classifications also provide a tool for determining the extent of an individual patient's capacity for successful retaining. One can then discriminate between those patients in whom the investment of retraining funds would be reasonably worthwhile and those in whom such an investment would not be productive.

024 Orthotics and Prosthetics Design Improvements

Principal Investigator:	H. R. Lehneis, Ph.D.	
1976		
Status:	Continuing	
Dates:	October, 1966-October, 1978	
Cost:	Annual $60,095 RT Annual $52,095	Projected Total $700,000 RT % of Annual Total 87%
Annual Report Reference:	#14, Page 183, R-59	
1977		
Status:	**Continuing**	
Dates:	**October, 1966**	
Cost:	**Annual $53,865** **RT Annual $51,697**	**Projected Total $520,000** **RT % of Annual Total 96%**
Annual Report Reference:	**#15, Page 105, R-59**	

OBJECTIVES:

1. **Pressure Mapping:** To establish and test a clinically applicable method of graphically quantifying static pressure over large complex surfaces at all points simultaneously.

2. **Universal Terminal Device:** A prosthetic terminal device is being developed that provides function similar to that of a hook but looks like a hand. This is to eliminate that stigma associated with the appearance of a hook, yet to provide the superior prehensile function of a hook.
3. **Electric Arm Orthosis:** A powered orthosis is being developed that provides prehensile function as well as essential degrees of freedom for arm functions to allow for needs of Activities of Daily Living and to reach certain vocational goals.

METHODOLOGY: Research and Development through prototype testing.

FINDINGS TO DATE:

1. **Pressure Mapping:** The constraints of the specific clinical applications described in the previous and present report and other experience have led to a refinement of the pressure mapping technique to the extent that the project can be considered complete as of this report. In summation, the methodology evolved through three distinct phases:
   1. Quantification of a microcapsule system
   2. Modification and utilization of above microcapsule contents.
   3. Use of reactants in 2 above, again modified, to be compatable with an altered physical configuration of the transducer.
2. **Universal Terminal Device:** During the past year efforts were directed, in part, to a more formal interdepartmental approach to the problem. This not only facilitated the "take-home" evaluation but should assist dissemination.

   During this period, two of our prototypes developed were fitted to patients who were allowed to use these devices outside the laboratory. They were, nevertheless, used only in their homes since good cosmesis has not yet been achieved. Also, the problem of durability has not yet been solved so that long term use was not possible. Nevertheless, patient reaction was favorable and encouraging.
3. **Electric Arm Orthosis:** As a result of patient tests the control system was refined from three independent switches mounted in the head piece through a "joy stick" – like lever arm such that contact with the control system is continuously maintained. This insures the "referring" that is necessary to "find" the proper switch at the proper time and also reduces head motions needed. The cosmesis of the control system was also greatly improved.

APPLICABILITY: Since this system enables the clinician to predict future pressure-induced skin ulceration and allied difficulties without the use of complex, expensive equipment and additional technical assistance, the efficiency of the rehabilitation process is expected to increase and resultant costs are expected to decrease. Consumers will be the general upper limb amputee population who currently use one or more types of terminal devices.

025 Bone Mineralization in Spinal Cord Injured Man: A Biochemical and Radiologic Investigation

Principal Investigator:	N. Eric Naftchi, Ph.D.	
1976		
Status:	Continuing	
Dates:	September, 1969-September, 1979	
Cost:	Annual $67,295 RT Annual $15,295	Projected Total $600,000 RT % of Annual Total 23%
Annual Report Reference:	#14, Page 189, R-60	
1977		
Status:	**Continuing**	
Dates:	**Sept., 1969-Sept., 1979**	
Cost:	**Annual $51,204** **RT Annual $15,178**	**Projected Total $525,000** **RT % of Annual Total 30%**
Annual Report Reference:	**#15, Page 113, R-60**	

OBJECTIVES:

1. To determine the causes of excessive bone demineralization in patients with paralysis due to spinal cord lesions.

2. To prevent demineralization.
3. To arrest and treat complications of osteoporosis by controlling calcium and phosphate metabolism.
4. To elucidate the cause of myositis ossificans and thereby prevent the restrictive, debilitating effects, either by inhibiting its formation, or once formed, cause its resorption or maturation by pharmacologic means.

METHODOLOGY:

1. The objective of this study is to arrest bone absorption and favor bone deposition by means of administering several therapeutic agents separately and in combination. The pharmacologic agents will be inorganic phosphates (Hyper-phos. K), diphosphonates, and thyrocalcitonin. The following techniques will be employed to determine successful therapy: (a) chromium corrected phosphate, calcium, magnesium, nitrogen balances will be studied for two consecutive four-day periods after appropriate equilibriation; (b) radiographic measurement of metacarpal and metatarsal cortical thickness; (c) quantitative, serial measurement of forearm and leg bone density by means of gammaphoton denistometer.
2. The results of quantitative serial measurements of bone density by simultaneous radiographic and gamma-photon densitometry and ^{18}F uptake will be correlated with mineral balance and collagen turnover in acute and chronic quadriplegia and paraplegia. These results, in turn, will be compared in patients with a different level of spinal cord transection in acute, recovery, and chronic phases in order to determine the effects of various levels of transection of spinal cord on skeletal demineralization.

FINDINGS TO DATE:

1. Bone mineral content was measured by single photon absorptiometery using a modified Packard bone densitometer with ^{125}I as the source. In 45 hemiplegic subjects, matched for sex and age, the bone density was compared bilaterally on the radius and ulna two and four centimeters above the wrist. The non-paralyzed side served as a control for the paralyzed side. There was an equivalent number of right-dominant, right-paralyzed and left-dominant, left-paralyzed subjects. The results indicate a consistent, general loss of bone mineral on the paralyzed side compared with the non-paralyzed side. Right-dominant, left-paralyzed patients showed a greater loss of bone density than left-dominant, right-paralyzed subjects. The absorption ratio of the paralyzed versus the non-paralyzed sides revealed that there was a 6.8% and 7.3% decrease in the average bone density at four centimeters and two centimeters above the wrist, respectively. There was a progressive loss of bone mineral content relative to time after the onset of paralysis, amounting to an average of 5% from both sites measured approximately three months after onset of injury. The effect of physical and drug therapy on the rate of demineralization following paralysis remains to be elucidated.
2. This study was undertaken to assess the feasibility of the osteodensitometry for determination of bone mineral content. Hemiplegic subjects were chosen as simpler models in order to compare the paralyzed with non-paralyzed arm and to set-up the technique for spinal cord injured subjects who are more challenging to study. The progressive loss of bone mineral content relative to the time after the onset of paralysis will be measured as above in spinal cord injured subjects in order to determine the extent of bone demineralization and the effect of drug treatment.
3. Urinary excretion of magnesium and calcium was measured in 11 quadriplegic and 7 paraplegic subjects from the date of the onset of injury and was followed longitudinally once a week for a period of 15 to 24 weeks. Both groups of subjects excreted calcium and magnesium significantly higher than normal during the first eight weeks after the injury. The mean levels gradually decreased towards but did not reach normal levels 24 weeks later. The excretion of calcium in both quadriplegic and paraplegic subjects was of the same magnitude but the excretion of magnesium in paraplegic subjects was about 75% of that in quadriplegic subjects.

APLLICABILITY: Calcium and phosphate metabolism is deranged in spinal cord injured humans. The associated complications, kidney stone, myositis ossificans, bone pain and fractures limit the independence, employability and rehabilitation of spinal cord injured man. In the present study, under dietary control, calcium and phosphate metabolism will be determined before and after specific treatment and correlated with bone density measurements and other biochemical findings. These treatments have proven successful in arresting bone resorption and favoring bone deposition in animals and some humans with bone fractures. The development of methods for the control of calcium and phosphate metabolism in spinal cord injury is essential in order to reduce debility, protracted and recurrent hospitalization of these patients.

026 Sympathetic Activity and the Metabolism of Biogenic Amines in Spinal Cord Injured Patients

Principal Investigator:	N. Eric Naftchi, Ph.D.	
1976		
Status:	Continuing	
Dates:	September, 1968-September, 1979	
Cost:	Annual $93,870 RT Annual $6,670	Projected Total $950,000 RT % of Annual Total 7%
Annual Report Reference:	#14, Page 195, R-61	
1977		
Status:	**Continuing**	
Dates:	**Sept., 1968-Sept., 1979**	
Cost:	**Annual $71,661** **RT Annual $14,007**	**Projected Total $813,000** **RT % of Annual Total 20%**
Annual Report Reference:	**#15, Page 119, R-61**	

OBJECTIVES:

1. To determine the relationship between cutaneous circulation and catecholamine metabolism in paraplegic and quadriplegic subjects with the purpose of elucidating the cause of trophic skin ulcers and spacticity.
2. To measure the effect of various levels of injury on the metabolism of catecholamines and correlate the degree of derangement in regulatory, integrative and stress functions with concentration of these neurotransmitters and their metabolites.
3. To measure the degree of sympathetic activity in different levels of spinal cord injury.
4. To develop measures for reducing the incidence of decubitis ulcers in the spinal cord injured human.

METHODOLOGY:

1. Catecholamines and their metabolites will be measured in plasma and urine and spinal fluid of cord transected individuals. Various levels of cord transection and their effect on these hormones and neurohormones will be investigated. Methods used include column and bidimensional paper and thin layer chromatography, ultra-violet fluorescent and atomic absorption spectroscopy; and the use of ultracentrifuge scintillation spectometry and strip scanning for radioisotopic analysis of the hormones and ions involved. Sympathetic activity will be evaluated by reactivity of the patients to exogenously infused norepinephrine, tyramine or angiotensin. Digital calorimetry will be used for the studies on reactivity to norepinephrine or other pressor substances. Gas-liquid chromatography, mass spectrometry and infrared spectrometry will also be employed for separation and identification of unknown compounds.
2. Digital blood flow will be measured calorimetrically and by means of mercury-in-rubber Whitney strain gauge.
3. Skin biopsies from ulcerated and healthy skin will be frozen and compared by microscopic fluorescence technique for their content of biogenic amines, i.e. norepinephrine, epinephrine, serotonin, and histamine.

FINDINGS TO DATE:

1. In seven C5-C7 quadriplegic subjects blood volume was measured by means of double isotope technique, using 125 I and 51 Cr. In five other C5-C7 quadriplegic subjects autonomic hyperreflexia was induced by expansion of the urinary bladder by means of water intake. Cardiac output was measured by indicator dilution method and arterial blood pressure by auscultatory technique. During hypertension there was no appreciable change in either cardiac output or cardiac index. By contrast, there was a significant rise in mean arterial blood pressure and total peripheral resistance and a sharp fall in pulse rate. Preliminary studies on blood volume reveal that during hypertension there is a 10% rise in hematocrit but relatively little change in total blood volume. These results indicate that during hypertension there is: (1) an increase in hemoconcentration, probably due to an increase in capillary permeability; (2) hypertension is caused mainly by a pronounced decrease in blood flow of the upper and lower extremities and by a sharp increase in the total peripheral resistance. This marked vasoconstriction correlates with increased activity of serum dopamine-B-hydroxylase, the enzyme responsible for the synthesis of the neuro-transmitter,

norepinephrine. This enzyme is released together with norepinephrine during hypertensive stress (Naftchi, N.E., et al, Frontiers in Catecholamine Research 1973 pp. 1143-47, Pergamon Press) and is thus an index of sympathetic activity (Naftchi, N.E., et al., Circ. Res. 35:850-6, 1974).

2. Reactivity of the digital vascular bed to infused 1-norepinephrine (NE) was measured in 15 subjects with complete physiologic transection of the spinal cord at various levels and was compared with that of 16 normal subjects. At least one hour before the test a continual bladder drainage was insured by means of an indwelling Foley catheter imbedded in Lidocaine gel. Sympathetic nerve discharge was inhibited by indirect heating of the subjects and continuous infusion of trimethaphan camphorsulfonate (TMCS), a ganglion blocking agent. Following the measurement of digital blood pressure and flow in this phase of vasodilation, vasoconstriction was brought about by infusion of NE while the infusion of TMCS continued. Flow-pressure ratios were converted to radius equivalents of digital circulation and the work of vasoconstriction was quantitated in ergs per microgram of NE infused per minute. The reactivity of NE in paraplegic subjects with lesions below the T6 dermatome was within the range found for normotensive subjects. In subjects with spinal cord transection above the T6 dermatome, reactivity to NE was more than two-folds greater than that of normotensive and paraplegic subjects with lesion below T6 dermatome. The significance of these findings with respect to denervation supersensitivity and the level of spinal cord lesion are being investigated further.

APPLICABILITY: Too frequently, after substantial investments are made in the physical and vocational training of paraplegic and quadriplegic patients numerous complications arise which necessitate re-hospitalization, frequently for a prolonged period, and thus jeopardize further employment of the patients in their prehospitalization job or a new job following discharge from the hospital. If through the proposed investigation the basic underlying physiological factors which contribute to decubiti, urinary infection, and other similar complications could be identified and possibly brought under control, the vocational rehabilitation of these severely disabled persons would be greatly enhanced.

027 Dysfunction of Endocrine Glands in Spinal Cord Injury

Principal Investigator:	N. Eric Naftchi, Ph.D.	
1976		
Status:	New	
Dates:	September, 1974-September 1979	
Cost:	Annual $28,835 RT Annual $5,635	Projected Total $265,000 RT % of Annual Total 20%
Annual Report Reference:	#14, Page 237, R-81	
1977		
Status:	**Continuing**	
Dates:	**Sept., 1974-Sept., 1979**	
Cost:	**Annual $54,614** **RT Annual $18,561**	**Projected Total $321,000** **RT % of Annual Total 34%**
Annual Report Reference:	**#15, Page 138, R-81**	

OBJECTIVES: The objective of this research is to examine critically endocrine function in paraplegic and quadriplegic subjects by means of exact and sensitive tools of radioimmunoassay and gas-liquid chromatography, to assay in blood the major hormones, and to analyze in urine 17-hydroxycorticosteroids, 17-ketosteroids, aldosterone, and reninangio-tensin as described in the Methodology.

METHODOLOGY: The ability of 131 I or 125 I-labelled hormones to compete with unlabelled hormones for antibody has been utilized in the radioimmunoassays for human growth hormone (1), rat (2,3) human (4), bovine (7), LH, FSH (5), and rat prolactin (6). Purified hormones are iodinated by modifications of the method of Greenwood et al., 1963 (8) using chloramine-T as the oxidizing agent.

FINDINGS TO DATE:

1. The concentration of testosterone in serum and the level of 17-Ketosteroids in urine of seven paraplegic and nine quadriplegic subjects were measured from the date of onset of the injury and were followed longitudinally once a week for a period of 15 to 30 weeks.

2. From the date of onset until three to eight weeks later, serum testosterone levels were about one-half that of normal controls but reached and remained at about normal levels thereafter. The concentrations of urinary 17-Ketosteroids followed approximately the same trend as that described for serum testosterone. Urinary 17-Ketosteroid levels; however, exhibited sharp weekly fluctuations from one-half below to low normal values. The latter results may suggest a derangement in regulation of synthesis or metabolism of androgens in spinal cord injured subjects.
3. Urinary 17-Ketosteroid levels were lower than normal values in paraplegic subjects. In quadriplegic subjects, however, 17-Ketosteroid excretion remained approximately normal. The results suggest a derangement in the regulation of synthesis and/or metabolism of neurotransmitter and androgens due to a disturbance in hypothalamic pituitary-gonadal axis.

028 Evaluation of Various Electronic Devices to Increase Mobility and Independence of Very High Level Quadriplegic Patients (Above C5)

Principal Investigator:	Heiner Sell, M.D.	
1976		
Status:	New	
Dates:	October 1974-September 1977	
Cost:	Annual $53,780 RT Annual $22,080	Projected Total $140,000 RT % of Annual Total 41%
Annual Report Reference:	#14, Page 243, R-82	
1977		
Status:	**Continuing**	
Dates:	**October, 1974-September, 1977**	
Cost:	**Annual $105,941** **RT Annual $99,666**	**Projected Total $270,000** **RT % of Annual Total 94%**
Annual Report Reference:	**#15, Page 143, R-82**	

OBJECTIVES: The general objective of this project is to determine which electronic equipment can best be utilized in the rehabilitation of the severely disabled quadriplegic by the evaluation of various types of such equipment.

METHODOLOGY:

1. During the past year on-going investigation of existing electronic devices has been continued, as well as testing of newly introduced commercial items. In addition, prototype devices developed in-house or by outside manufacturers have been tested.
2. A total of 20 high level spinal cord injured patients who were seen at IRM during the period June 1, 1975 to May 30, 1976 were given an opportunity to try any or all of the various electronic devices: Breath operated wheel chairs, breath operated environmental controls, breath operated vocational and recreational devices.

FINDINGS TO DATE: Future work: Following discussion with our advisory committee, we are actively pursuing investigation of voice controlled equipment. It is recognized that the currently prohibitive cost of reliable voice controlled equipment generally would prevent current home installation of such equipment, regardless of superior performance or patient preference. Investigation in this area is essential, however, because, as emphasized by patient members of our advisory committee, all switches (tube, microswitch, etc.) with which an individual must physically come into contact, will be inoperative if the individual moves out of range of that switch. The spinal cord injured patient experiences muscular spasms on a regular basis. Therefore, he occasionally moves away from a breath tube or other switch and cannot operate any equipment or assistance call until an unsummoned individual arrives to reposition the individual or the switch.

APPLICABILITY: A leading international manufacturer of wheelchairs has accepted the 1-tube IRM Breath Control for production. Three prototypes from them are projected to be ready for in-house testing as a preliminary to national marketing.

The manufacturer of one environmental control device (Robot) has reported that our evaluation findings are being considered in the redesign of their device.

029 Demonstration of Benefits of Early Identification of Psychosocial Problems and Early Intervention Toward Rehabilitation of Cancer Patients

Principal Investigator:	Leonard Diller, Ph.D.	
1976		
Status:	New	
Dates:	June, 1975-August, 1978	
Cost:	Annual – RT Annual –	Projected Total – RT % of Annual Total –
Annual Report Reference:	#14, Page 259, R-84	
1977		
Status:	**Continuing**	
Dates:	**June, 1975-December, 1978**	
Cost:	**Annual $171,611** **RT Annual $18,849**	**Projected Total $723,000** **RT % of Annual Total 11%**
Annual Report Reference:	**#15, Page 158, R-84**	

OBJECTIVES: This investigation consists of two studies. Study I attempts to develop a taxonomy of psychosocial and vocational problem domains in a group of patients who have had access to the proposed type of intervention program. It serves the function of generating a comparison group with regard to outcome measures without having to withhold treatment. Study II serves to develop a method of identification of patients and patterns of intervention and treatment.

METHODOLOGY: Phase I will provide a data base which will allow the description of:

1. What kinds of psychosocial problems cancer patients have six months following medical treatment and thereafter.
2. How psychosocial problems vary as a function of site of cancer, severity of disease, demography, etc.
3. Lawful relationships which might be used to differentiate those patients with few problems from those with many.

The revised plan of the study calls for two control groups. One control group will be accessed prior to the intervention program and the second will be accessed after all Ss have been accessed into the intervention program.

FINDINGS TO DATE:

1. The data collection and coding of sections Phase I of the project were completed on April 30, 1976. The data is currently being readied for computer processing and analysis. It is projected that the write-up for Phase I will be correlated by July 30, 1976. What follows is a brief description of the methodology employed and patients seen in Phase I.
2. The development, delivery, and evaluation of this comprehensive psychosocial intervention program constitutes Phase II of the project.
3. The first year of the project has involved fulfilling the objectives of Phase I.
4. The data generated from Phase I and the literature indicate that an individual with a single primary cancer is not the same as one with metastatic disease. In Phase I, approximately 30% of the Ss in each of the groups had metastatic disease. At present we are determining if numbers will be sufficient to allow the inclusion of both types of patients, in other words, stratification by metastatic vs. primary disease. If not, the study should be restricted to patients with primary disease.

APPLICABILITY: The results of Phase I will provide a context for understanding and viewing for psycho-social problems of cancer patients as they impact upon vocational rehabilitation.

030 Motor Conduction Velocity Measurement in Myotonic Dystrophy

Principal Investigator:	Arthur Eberstein, Ph.D.	
1976		
Status:	New	
Dates:	September 1975-September 1978	
Cost:	Annual – RT Annual –	Projected Total – RT % of Annual Total –
Annual Report Reference:	#14, Page 260, R-85	
1977		
Status:	**Continuing**	
Dates:	**September 1975-September 1978**	
Cost:	**Annual $56,652** **RT Annual $35,490**	**Projected Total $168,000** **RT % of Annual Total 63%**
Annual Report Reference:	**#15, Page 169, R-85**	

OBJECTIVES: The objectives of this study are to determine whether nerve conduction in patients afflicted with myotonic dystrophy or myotonic congenita is impaired, and whether there is any nerve involvement of parents and siblings of these patients.

METHODOLOGY:

1. Patients with clinical and electromyographic findings characteristic of myotonic dystrophy or myotonic congenita will be accepted as subjects for this study. Both female and male patients of all ages will be tested. The population sample will consist of at least 50 subjects. Control values will be those already established in this laboratory.
2. Conduction velocities will be determined in the median, ulnar and peroneal nerves and sensory latency times in the median and ulnar nerves of each subject. The procedure to be followed has been described in the book by Goodgold and Eberstein (Electrodiagnosis of Neuromuscular Diseases. Williams and Wilkins, 1972, Ch. 6). Essentially, nerve conduction velocities of motor nerve fibers are determined from measurements of the latencies of potentials evoked in the muscle after nerve stimulation at two different points along its length.
3. The mean conduction velocity and mean latency time as well as standard deviations will be calculated for each nerve, and the T-test will be applied to the means of corresponding nerves (normal vs. myotonic patients) to determine the significance of the difference.

FINDINGS TO DATE:

1. Fourteen patients were found to have myotonic dystrophy but only ten of these were considered free of complications, such as, diabetes, to be included in this study. Latencies and conduction velocities were normal in 6 of the 10 and four had abnormal findings. In the latter group, all showed abnormal conduction in the peroneal nerve, that is, prolonged distal motor latency and decreased motor conduction velocity or, as seen in one patient, no response at all in this nerve. Also, one patient had lower motor conduction velocities in both the median and ulnar nerves and increased latency time for the median sensory nerve fibers.
2. It is too early in the study to draw any conclusions. Our main finding to date is the abnormal conduction in the peroneal nerve which confirms the results reported recently by other investigations (Ballantyne and Hansen, J. Neurol. Neurosurg. Psychiat., 37:1195, 1974). Clinical examination of the four patients indicates that they are free of any other involvement so that the peripheral nerve impairment may be attributed to the myotonic dystrophy. Our attempts to correlate this with the duration or severity of the disease has not been successful as yet.

APPLICABILITY: Results of this study may be applied directly to current diagnostic electrophysiological procedures, thereby permitting a more accurate evaluation of the patient's condition and progress. It is important in rehabilitation of the handicapped client to know whether the nervous system is intact and functioning properly or whether the disability lies solely in the skeletal musculature. Findings will establish early in the examination whether there is nervous system involvement.

We also anticipate that our examination of parents and siblings may enable us to detect this disorder earlier than is now possible. Treatment and rehabilitation could then be established to halt or possibly reverse the severity of the disabling progression.

031 Rehabilitation Indicators: A Method for Enhancing Accountability

Principal Investigator:	Leonard Diller, Ph.D.	
1976		
Status:	New	
Dates:	October, 1974-October, 1979	
Cost:	Annual $41,094 RT Annual $38,694	Projected Total $600,000 RT % of Annual Total 94%
Annual Report Reference:	#14, Page 263, R-88	
1977		
Status:	**Continuing**	
Dates:	**October, 1974-October, 1979**	
Cost:	**Annual $85,391** **RT Annual $79,569**	**Projected Total $381,000** **RT % of Annual Total 93%**
Annual Report Reference:	**#15, Page 175, R-88**	

OBJECTIVES:

1. To enhance the accountability (decision making and information flow) of rehabilitation systems to both funding sources and clients.
2. To enhance the process of rehabilitation by providing a rational basis for planning, tracking and follow-up.

METHODOLOGY: The major activity of this project has been the development of a language that describes those activities, environmental factors and client statuses which facilitate or impede rehabilitation or may serve as goals of rehabilitation. Thus, the language has three major dimensions and three **types of rehabilitation indicators** have been developed.

1. **Activity indicators** describe client skills and functional behaviors, e.g., walking up stairs, arriving at work on time, reading a newspaper.
2. **External indicators** describe environmental factors that can influence the client's goal attainment, e.g., narrow doorways, family support, the local unemployment rate.
3. **Status indicators** describe client statuses, which are defined as complex activities implemented in the environment, which describe key indicators of quality of life, e.g., being employed competitively, living outside an institution, independently caring for oneself, being socially active.

FINDINGS TO DATE: A lexicon has been developed which consists of three sets of indicators which constitute an objective and hopefully clarified language for rehabilitation. This modified language can be implemented in many ways within varying rehabilitation systems, including the use of the lexicon within a structured interview, an unstructured interview, and/or within an observation paradigm. The particular method selected would depend on factors such as the type of client, the type of rehabilitation services and the type of rehabilitation setting.

The focus of the lexicon is behavioral and observable, but not behavioristic, in that no particular theory of behavior is adopted nor any behavior change methods.

APPLICABILITY: Status indicators, activity indicators and external factor indicators can be used within the process of rehabilitation, utilizing a basic systematic approach. In this approach the rehabilitation indicators would be used to fulfill several purposes, including defining status goals, necessary skills, and external strengths and problems, for the purpose of individual rehabilitation planning, and defining changes in status activities and external factors for evaluation purposes.

032 Modular Hyperbaric Oxygen Treatment of Pressure Sores and Traumatic Skin Lesions of the Torso

Principal Investigator:	**Boguslav H. Fischer, M.D.**	
1977		
Status:	**NEW**	
Dates:	**October 1975-October 1980**	
Cost:	**Annual $8,315** **RT Annual $3,487**	**Projected Total $42,000** **RT % of Annual Total 42%**
Annual Report Reference:	**#15, Page 195, R-89**	

OBJECTIVES:

1. Construction of physiologically proper cups and miniature chambers permitting the enclosure of an ulceration existing on a flat surface of the human torso (Sacrum, vertebral spine).
2. Identification of proper gasketing material, either silicon or natural rubber.
3. Identification of proper durometer of the gasketing material.
4. Development of oxygen delivery system permitting either constant or pulsed pressure application of oxygen.
5. Development of proper shape of the sealing material placed between the cup and skin.

METHODOLOGY:

1. Patients will be selected from the New York University Medical Center. The progress of healing will be monitored by photographic documentation, actual measurements of skin ulcerations, and serial bacterial cultures.
2. Any practical findings during actual treatment and operation of the devices will be immediately incorporated in new designs.
3. The response of the lesions to oxygen applied under various pressures will be observed.

FINDINGS TO DATE:

1. The development proceeds along two avenues: the first one incorporates a rigid plastic cup enclosing the skin lesion, the second presents a soft, plastic "bubble" type chamber sealed to the skin by means of an adhesive strap.
    a. In the first model hermeticity of the cup is achieved by means of gravitational forces. As a result, treatment time is limited to one hour only in order to prevent the occurrence of pressure sores along the contact line of the sealing gasket.
    b. The second type permits a controlled sealing pressure chamber allowing prolonged exposure of the skin lesion without any danger of circulatory restriction.
2. Hyperbaric oxygen proved to be extremely effective in rapid control of infected post-surgical wounds, frequently achieving a total control of the situation within first 24 hours after commencement of treatment.
3. It proved to be life-saving to one patient where the wound break-down reached the fural appendages of the spinal cord.
4. In all cases there was a rapid healing response permitting far earlier discharge from the hospital or earlier commencement of rehabilitation treatment.
5. One paper is in preparation.

APPLICABILITY: Since topical hyperbaric oxygen does not require any special installations or modifications and can be applied directly on patient's wards the method may be used widely in hospitals and nursing homes with extended facilities.

It will substantially shorten the healing time permitting an earlier rehabilitation and earlier return to productive life.

033 Pathomechanics of Upper Limbs as a Basis for Improved Prosthetic and Orthotic Design

Principal Investigator:	**Erwin R. Tichauer, Sc. D.**	
1977		
Status:	**New**	
Dates:	**January 1976-December 1980**	
Cost:	**Annual $49,608** **RT Annual $42,371**	**Projected Total $250,000** **RT % of Annual Total 85%**
Annual Report Reference:	**#15, Page 200, R-90**	

OBJECTIVES:

1. To develop a system for the measurement and evaluation of the pathomechanics of upper-extremity rehabilitees.
2. To investigate means of measurement of physiological energy consumption and available techniques in electromyographic kinesiology in order to evaluate their usefulness for the measure-

ment of energy requirements of prosthetic and orthotic devices in the performance of common upper-extremity tasks.

3. To correlate objective measurement of energy demand and physical activity with objective evaluation of devices by patients.

METHODOLOGY: Inasmuch as equipment development and biomechanical analyses of prosthetic devices must precede experimentation, this project is still in the stage of design of instrumentation and research devices necessary for patient evaluation and experimentation. It is expected that the battery of evaluation devices will be completed in the course of the next reporting period. Likewise, this period will be utilized to develop sound pictorial experimental designs.

FINDINGS TO DATE:

1. Two identical Form Boards were instrumented. Each one accommodated twelve objects of various geometric shapes, materials, weights, and sizes. A standardized procedure was developed where experimental subjects removed objects from one board and positioned them in the homologous receptacle on the contra-lateral board. The boards were instrumented for "on line" processing by laboratory computer so that the individual motion elements such as "Reach", "Grasp", "Disengage", "Transport", "Position", and "Release" were automatically recorded and their time values computed. The task was performed by amputees wearing below elbow prostheses equipped with a Lyre Point Hook. Twelve disabled subjects and a matching sample of unimpaired individuals were employed.
2. Elemental analysis of movements and motion times was performed. Differences between the disabled and the unimpaired relating to the manner in which the task was performed and the time required to complete the job were established. A formula was developed permitting the prediction of performance time standards for below elbow amputees using standard Methods Time Measurement tables. Statistical tests proved that amputee performance of industrial motion elements could be reliably predicted with this procedure. However, the experimentation was primarily conducted to validate and test the apparatus constructed and it is deemed that the subject sample is as yet too small for definitive conclusions to be drawn. Resulting from this phase of the investigation was a Master's Thesis by I. Gilad entitled: "A Comparison of the Industrially Useful Manipulative Patterns of Unimpaired Workers and Those Using Below Elbow Prostheses".

APPLICABILITY: The primary consumers of the results of the study will be upper extremity amputees and rehabilitees who seek gainful employment in industry. Vocational assessment and the prescription of assistive devices most frequently take place in vocational rehabilitation centers and industrial medical departments, therefore, these are expected to become the vehicles for the utilization of results.

034 Development of Electronic Systems to Provide Increased Vocational Independence and Recreational Facilities for High Level Quadriplegics (Above C5)

Principal Investigator:	**Calman Gold, M.E.**	
1977		
Status:	**New**	
Dates:	**October 1975-September 1978**	
Cost:	**Annual $27,774** **RT Annual $15,404**	**Projected Total $87,000** **RT % of Annual Total 55%**
Annual Report Reference:	**#15, Page 207, R-91**	

OBJECTIVES: The general objective is to design, develop, and evaluate new and improved electronic vocational aids and recreational facilities to meet the specific needs of the high quadriplegic patient population. A second objective of this project is to work cooperatively with and to encourage the manufacturers of components and/or systems to be incorporated in new devices to assemble and make commercially available the products of this research.

METHODOLOGY: Development of the proposed systems will proceed by critically examining the specific needs and interface requirements of this patient population. Inquiries will be made and suggestions obtained as to desirable and undesirable design features of interfaces and equipment from an advisory group consisting of high quadriplegics, therapists, clinicians, and engineers. Once the requirements are conceptualized, engineering design will be effected with subsequent prototyping of systems. An important component of this process will be the recommendations of manufacturers of the electronic and mechanical components intended for use in these systems. Once prototyped, these devices will be made available for patient evaluation through the Occupational Therapy Department of the Center. Refinements and/or modifications will be implemented according to patient responses and the recommendations of occupational and vocational therapists. Finalized designs will be discussed with manufacturers in an effort to promote production and distribution of developments as consumer items for the patient population.

FINDINGS TO DATE: While the project only began in October, 1975, we have made considerable progress in the design and prototype fabrication of a pneumatically operated tape recorder/dictaphone system, suitable for use on a wheelchair lapboard and battery powered as well as suitable for use as a line-powered entertainment device or as an accessory to available multi-functional environmental control systems.

APPLICABILITY: Results of this research will significantly enhance the employability of the high quadriplegic in many occupational situations, and furthermore increase the quality of life for these individuals by providing enjoyment through recreational activity. The increased vocational and educational potential provided by the electronic devices described should likewise increase the economic independence and self-sufficiency of these patients, who would otherwise remain completely dependent upon full-time care by attendants for even the smallest needs as well as economic support by federal, state, and local social rehabilitation agencies. Furthermore, the psychological benefit to be derived from some modicum of achievement, self-sufficiency, and recreational enjoyment provided by the results of this research cannot be over-emphasized.

It is also believed that by working with commercial manufacturers and available products that the commercial availability, distribution, and quality of marketed systems will be considerably improved.

035 The Diagnosis and Remediation of Deficits in Visual Information Processing and Verbal Abstraction in Brain Damaged Adults

Principal Investigator:	**Leonard Diller, Ph.D.**	
1977		
Status:	**New**	
Dates:	**October 1975-December 1980**	
Cost:	**Annual $137,838** **RT Annual $32,431**	**Projected Total $685,000** **RT % of Annual Total 24%**
Annual Report Reference:	**#15, Page 219, R-92**	

OBJECTIVES: To develop and validate a normative scale and calibrated neuropsychologic module for the differential diagnosis of remediation and prognosis of dysfunctions of visual information processing in various types of brain damaged adults. This will further result in the development of a toxonomy of deficits of visual information processing found in brain damaged adults. These objectives may be broken down in terms of the objectives for each of four sub-studies to be carried out in three years.

METHODOLOGY: There are five sub-studies — each with a detailed methodology. Space does not permit their description. See findings.

FINDINGS TO DATE: During the past year 52 normals (age 45-75) were administered the test battery enumerated below. This was done in order to standardize the battery and derive a set of age appropriate norms. The battery has also been administered to 23 (13 left and 10 right) hemiplegics. 22-37 Additional hemiplegics will be seen during the next several months in order to complete the standardization process. Following this approximately 4 months will be devoted to pilot studies in training, commencing next spring with the start of the full blown training experiment.

Test Battery

Full WAIS
Conditional Cancellation (developed by Staff)
Embedded Figures (Ayers)

Cube Analysis (Stanford - Binet)
Perceptual Analysis and Synthesis (Birch & Lefford, 1965)
Autobiographical Statement (developed by Staff)
Parts of the Ravens (selected by Staff)
Parts of the Leiter (selected by Staff)
Goldstein Object Sorting Task
Visual Simultaneity (developed by Staff)
50 Visual and Pictorial Similarities (developed by Staff)
Trail Making (Part of Reitan Battery)
Knox Cube
Porteus Mazes
Symbol - Symbol (Jastak)
Visual Digit Span
Bender-Bestalt
Metropolitan Achievement Test (Comprehension and Arithmetic)
Simultaneous Recognition (Developed by Staff)
Paragraph Titles
Impersistence
DSS

APPLICABILITY: Hemiplegia constitutes the largest physical disability group with an estimated prevalence of 200-2,000 per 100,000. Our previous studies have indicated that perceptual disorders common to right brain damage are critical bottlenecks in successful rehabilitation (Diller, et al.) (Lorenz & Cancro).

036 Electronic Anal Spincter Stimulation for Fecal Incontinence Control and Barium Enema Examination of Disabled Persons

Principal Investigator: **Boguslav H. Fischer, M.D.**
1977
Status: **New**
Dates: **October 1975-October 1980**
Cost: **Annual $8,315** **Projected Total $45,000**
RT Annual $3,487 **RT % of Annual Total 42%**
Annual Report Reference: **#15, Page 248, R-95**

OBJECTIVES:

1. Construction of properly shaped anal plug
2. Construction of stimulating generators
3. Construction of safety circuits to prevent accidental perforation of the colon

METHODOLOGY:

1. Two populations will be selected.
2. The first group will consist of patients who present fecal incontinence as a major debilitating factor in their rehabilitation and return to productive life. Stimulation of the anal spincter muscle will be anteceded by appropriate EMG examination of the anal sphincter muscle in order to gather objective information.
3. The response and degree of restoration of fecal continence will be monitored by close follow-up of the patient either on ward or on an out-patient basis.
4. The second population group will consist of patients who for various reasons could not retain the contrast material during X-ray examination using standard methods including injections of Valium and Glucagon. Both in- as well as out-patients will be accepted in this study. The study will be performed in close cooperation with the Department of Radiology, New York University Medical Center.

FINDINGS TO DATE: The electronic anal sphincter stimulation proved to be highly successful in barium enema examination. It was of particular help in the examination of disabled patients presenting with spinal cord injuries and hemiplegias. In one paraplegic patient a sigmoid carcinoma was detected though biopsy was reported as negative. There were only 5 failures in a total study of 60 patients.

APPLICABILITY: It is expected that the development of proper anal sphincter stimulation technic can be of enormous help to the debilitated patient as well as instrumental in barium enema examinations in those patients who cannot retain the contrast material.

037 Feedback Control System for the Paralyzed

Principal Investigator:	**Warren Frisina, B.E.**	
1977		
Status:	**New**	
Dates:	**October, 1975-September, 1980**	
Cost:	**Annual $29,722** **RT Annual $24,435**	**Projected Total $180,000** **RT % of Annual Total 82%**
Annual Report Reference:	**#15, Page 253, R-96**	

OBJECTIVES: Transfer and/or develop feedforward and feedback control elements to replace the human biological counterpart lost through paralysis in order to control devices designed to aid in Activities of Daily Living and vocational readjustment.

METHODOLOGY:

1. Particular controlled elements will be selected.*
2. Feedforward control elements, i.e., myoelectric with attendant training methods and instrumentation, will be interfaced with the above.
3. Feedback control elements, i.e., to produce pressure and proprioceptive sensation, will be interfaced with the above.
4. The population sample will include quadriplegics and others suffering from paralysis (sensory and/or motor).
5. Evaluation criteria will include formal interdepartmental participation as well as consumer groups.
6. Sequence for each controlled device:
    1. Set controlled device priority.
    2. Map likely control sites on body.
    3. Establish tentative training methods.
    4. Interface patient with feedforward elements.
    5. Combine "1" and "4" above.
    6. Develop feedback elements.
    7. Combine "3" and "6".
    8. Revise where necessary.
    9. Combine "1", "4" and "6".

* See RT-1 projects R-82 and R-59.

FINDINGS TO DATE: It was found that ordinary disposable electrodes are too large for this work; miniature surface silver/silver chloride electrodes were then used. However, the following criteria have been tentatively established for electrodes to be used in the home environment of the patient:

1. Ease of application.
2. Should be able to remain on patient for at least 1 week.

3. Must be cosmetic (facial region).
4. Must have proper electrical characteristics.

An electrode survey is presently being conducted.

APPLICABILITY: Findings will aid the high level quadriplegic and other paralyzed individuals by enabling them to become more independent. Functional use of feedback control systems and attendant devices will help free them from constant human attendant care, facilitate finding employment in a suitable vocation, and improve quality of lifestyle by providing additional means of interacting with the environment.

038 Development of Transfer Devices for High Quadriplegic Patients

Principal Investigator:	**Robert G. Wilson, M.S.**	
1977		
Status:	**New**	
Dates:	**October, 1975-September, 1978**	
Cost:	**Annual $24,818** **RT Annual $18,004**	**Projected Total $80,000** **RT % of Annual Total 73%**
Annual Report Reference:	**#15, Page 257, R-97**	

OBJECTIVES: The aim of this project is to develop a transfer device for a high quadriplegic patient. The development consists of the following phases:

1. Careful investigation of present equipment.
2. Designing, developing and testing small-scaled mock-up models of a transfer device.
3. After careful selection of one of the mock-up models, the full size working model will be fabricated.
4. Testing of different patients on the model.

METHODOLOGY:

1. Physical examination of a high quadriplegic patient including range of motion, remaining muscle power and thorough skin check-up.
2. The patient will use a full size working model which initially is manually and later power operated. At first, the patient will use it in various areas of the Institute, and later, in his house.
3. Design and development of the transfer device to meet the patient's need.
   a. Fabrication of the final full size model
   b. The model electronically self-controlled by the patient
   c. If the patient is unable to use the electronically controlled model, a mechanically controlled model could be operated with minimum physical effort by a helper regardless of his strength and size.
4. An evaluation questionnaire will be filled out by each patient. Based on the patient's answers, further modifications of the model will be determined.

FINDINGS TO DATE:

1. On October 10, 1975 the first samples of the transfer device, i.e. small models and drawings were shown to the Regional Advisory Committee. They agreed that research and construction of these devices was of great importance and should be continued.
2. On March 10, 1976 the same and some additional models of a transfer device as above were presented to the Patient Advisory Board at New York University Institute of Rehabilitation Medicine. There was a discussion whether a highly sophisticated electronic self-controlled (by the patient) transfer device for a high quadriplegic patient should be continued — or whether to concentrate our efforts on the development of a simple mechanical device which could be controlled by one helper with minimal physical effort, regardless of the size of helper or patient.

3. It was agreed upon that it would be more practical to work on the simpler device first. A portable, mechanically controlled (by one helper) transfer device is being constructed now and will soon be patient tested.
4. Working on the above project it was found that the following devices for transfer would be a logical progression to meet more needs of the severely disabled:
    a. A self sliding transfer device built into a wheelchair would aid a high quadriplegic to move to a toilet from the wheelchair and back.
    b. Lightweight cart handled by an attendant would carry a quadriplegic up and down stairs easily.
    c. Special built-in device would aid a wheelchair to climb over a curb or several steps.
    d. Modifications of a conventional wheelchair would aid a quadriplegic in transfer to enter an automobile easily.

APPLICABILITY: The proposed device is also urgently needed by patients with severe and/or multiple disabilities other than spinal cord injuries, e.g. patients with involvement of all four extremities and trunk resulting from poliomyelitis, arthritis, multiple sclerosis, muscular dystrophy, etc. Since many of these patients can perform many daily activities much easier in the wheelchair than in bed, this device would provide at least some independent functioning.

University of Minnesota (RT-2)
Medical Rehabilitation Research and Training Center

CORE AREAS

Neuromuscular

Studies on causes, effects, responses and adaptations related to injury or impairment of function of prolonged duration in the neuromuscular system.

Psychosocial-Vocational

Research on problems in the psychological, social or vocational areas which relate to ability to adapt to or respond to the requirements of normal living.

Cardiac Rehabilitation

Research on cardiac, pulmonary and vascular requirements for activities throughout the range of normal performance and especially related to adaptation to the requirements of normal living following pathological changes.

Health Care Delivery

Research on health needs and the efficacy and efficiency of various modes of health services in relation to rehabilitation.

Education in Rehabilitation

Studies on needs, applications, adaptation and modifications of education related to rehabilitation.

Bionomic Adaptations

Research on methods for responding to or compensating for losses or impairments of interaction with the environment which increase the capacity for performance or the quality of life of the chronically ill or handicapped patient.

Ergonomics

Research on the quantitative evaluation of muscular force, work, power, and energy of man.

Spinal Cord Injury

Research on problems arising in rehabilitation and adaptation to living, including community integration in patients who have suffered spinal cord injury.

UNIVERSITY OF MINNESOTA

Frederic J. Kottke, M.D., Director
University of Minnesota Medical
Rehabilitation Research and Training Center
860 Mayo Building
Minneapolis, Minnesota 55455

PROJECT TITLES BY FY 1977 STATUS

Abstract No.

COMPLETED

Rehabilitation Policy Studies Part II: Quality Assurance (Thomas P. Anderson, M.D.) 039

A Study of the Development and Change of Attitudes of Medical Students Throughout the Time in Medical School (Pearl Rosenberg, Ph.D.) 040

Sexual Function in Physical Disability (Theodore Cole, M.D.) 041

Development of a Systematic Problem Solving Approach to the Practice of Rehabilitation Medicine (Theodore Cole, M.D.) 042

A Study of the Muscle Spindle of the Human Tongue Muscle (Ali Turkyilmaz Ozel, M.D) 043

Community-Based Growth Group for Disabled Persons (Nancy M. Crewe, Ph.D.) 044

CONTINUING

Studies of Urologic Function in Patients Following Spinal Cord Injuries (Mary Price, M.D.) 045

Study of Cardiac Work Evaluation and Reconditioning After Myocardial Infarction (William G. Kubicek, Ph.D.) 046

Quantitative and Qualitative Evaluation of Muscular Hypertonia in Patients with Central Nervous System Disease (Daniel Halpern, M.D.) 047

Study of the Changes in the Structure, Ultrastructure, Innervation and Enzymes of Skeletal Muscle in Neuromuscular Diseases (Essam Awad, M.D., Ph.D.) 048

Training Program for Upper Extremity Activities in Athetoid Patients (Daniel Halpern, M.D.) 049

Quantitative Studies of Muscular Strength and Muscular Work (Martin Mundale, R.P.T.) 050

The Evaluation of an Automated Training System for Wheelchair Pushups (Robert Patterson, Ph.D.) 051

Evaluation of Efficacy of Rehabilitation Programs (Frederic J. Kottke, M.D., Ph.D.) 052

A Followup Study of the Psychological, Social and Vocational Adjustment of Spinal Cord Injured Adults (Gary Athelstan, Ph.D.)	053
An Atlas of Vocational Histories of Persons with Spinal Cord Injuries (Nancy Crewe, Ph.D.)	054
An Evaluation of the Relationship of Self-Care Outcomes to Care in the Acute Hospital, the Rehabilitation Center, and to Post-Discharge Level of Function in Stroke Patients (K. Sperling, M.D.)	055
Voluntary Control of Autonomic Processes Using Biofeedback and Reinforcement Procedures (Alan H. Roberts, Ph.D.)	056

NEW

An Investigation of Decubitus Ulcer as Manifestation of Psychosocial Problem (Thomas P. Anderson, M.D.)	057
Bibliography of Psychosocial, Vocational, and Sexual Aspects of Spinal Cord Injury (Gary T. Athelstan, Ph.D.)	058
Validity and Reliability of Health Accounting Method of Quality Assurance in a Rehabilitation Setting (Thomas P. Anderson, M.D.)	059
A Study of the Golgi Tendon Organ in Human Muscles and Tendons (Rita Bistevins, M.D.)	060
Behavior Modification: A Problem-Oriented, Learning-Based Research Strategy for Rehabilitation (Jerry Martin, Ph.D.)	061
Followup Study of Patients Treated in the Pain Treatment Program Physical Medicine and Rehabilitation Service, University of Minnesota Hospitals (Alan H. Roberts, Ph.D.)	062
A Portable Exercise Monitoring System for Patients with Coronary Artery Disease (Turkyilmaz Ozel, M.D.)	063
The Value of LDH Isoenzyme Studies in Collagen Disease (Turkyilmaz Ozel, M.D.)	064
The Effect of Cervical Orthoses on Cervical Spine Motion: A Standardized Radiographic Method of Study (Steve Fisher, M.D.)	065

DISCONTINUED 1976

Evaluation of the Schiotz Tonometer for Estimated Changes of Intracranial Pressure in Infants (Jessie K. M. Easton, M.D.)

Relations Between Loudness and the Auditory Evoked Vertex Response (Frank Lassman, Ph.D.)

Short-Term Adaptation of the Auditory Evoked Vertex Response (Frank Lassman, Ph.D.)

DISCONTINUED 1977

Development of a Measurement Tool for Placements in Care Facilities
(N. Silberberg, Ph.D.) 066

TRANSFERRED 1976

Model Regional System of Spinal Cord Injury Rehabilitation (To Develop a
Plan for a Regional Center for Treatment of Spinal Cord Injured Persons (Theodore M. Cole, M.D.)

OTHER

Study of a Device to Support Unstable Feet in Children (suspended)
(John Allison, M.S., R.P.T.)

039 Rehabilitation Policy Studies: Part II Quality Assurance

Principal Investigator:	Thomas P. Anderson, M.D.	
FY 1976		
Status:	Continuing	
Dates:	October, 1972-Sept. 1976	
Cost:	Annual $51,342 RT Annual $37,708	Projected Total $222,000 RT % of Annual Total 73%
Annual Report Reference:	#14, Page 46, R-1	
FY 1977		
Status:	**Completed**	
Dates:	**October, 1972-May, 1976**	
Cost:	**Annual –** **RT Annual –**	**Projected Total–** **RT % of Annual Total –**
Annual Report Reference:	**#15, Page 215, R-1**	

OBJECTIVES:

1. To demonstrate the feasibility of estimation techniques in obtaining comprehensive rehabilitation cost/benefit estimates based on outcomes (Part I);
2. to demonstrate that prognostic estimates can be used in a practical ongoing quality assurance system based on rehabilitation outcomes (Part II). More specifically, to demonstrate the feasibility and acceptability of establishing an ongoing quality assurance program which follows up patients and compares their end results with outcome standards estimated by practicing professionals.

METHODOLOGY:

1. A health problem (hypertension, post-stroke disability) is chosen for study.
2. Strategy is planned and available data is collected.
3. A study team of experts in the particular study area is selected.
4. The study team defines the patient sample, the information to be collected, and estimates the outcomes criteria.
5. A "health accountant" determines actual outcomes of patient care and compares them with estimated standards.
6. The study team reviews performance against standards to determine if deviations represent deficiencies in patient care. If necessary, appropriate recommendations are made to improve care.
7. Results are documented by the study team for the Quality Assurance Board, who review, approve, and implement recommendations for corrective action. In addition, the Board will judge the success of the application and decide if it should be adopted on an ongoing quality assurance system.

FINDINGS TO DATE:

1. After completion of the Stroke Rehabilitation Outcome Study, chronic low back pain and urinary tract infection in spinal cord injured patients were studied using the health accounting methodology.
2. In both studies, patients were selected and interviewed by the health accountant after which they were graded on a function impairment scale that measures patient outcomes.

   The study participants, divided into two roughly matched teams, made more detailed investigations of 50 cases with less than optimal outcomes. The two teams showed certain differences in their judgments of adequacy of treatment based on outcomes and fifteen additional cases were evaluated and recommendations made to further assess the basis for these differences. The findings of the first completed outcomes assessment are being presented in a final report. Some relevant statistics include the outcomes of 110 patients with completed stroke who participated in a rehabilitation program. According to the measured outcomes, 3 percent of the patients were asymptomatic, 9 percent were symptomatic, but able to continue in prestroke activities, 31 percent were capable of self care, which means that 43 percent achieved independence again. Among the 20 percent in the dependent group, 8 percent required supervision, 8 percent were partially dependent, and 4 percent were totally dependent. Thirty-seven percent had died. These outcomes were better than the estimated made by the study participants. Because of the general impression of many physicians that stroke patients need institutionalization, decline progressively, and die soon after an initial stroke, study participants were encouraged that outcomes on their samples contradicted these assumptions. Forty-six of the 67 interviewed patients were living at home with families (68 percent) and 9 former patients were living independently (13 percent). Twelve patients (18 percent) were in nursing homes. Forty-four (66 percent) surviving patients had improved or maintained the functional status attained at discharge. While only a few of the deceased cases were reviewed because of lack of available information, it appeared that few of the deaths could have been prevented by better medical care. Where an outcome was judged improvable, the cause seemed to lie more in failure of links between medical care systems, than individual professional incompetence. In other words, failures to achieve the most optimal outcomes were more likely to result from delayed initial referral or deficient followup, rather than inadequate rehabilitation therapy.

3. A summary of outcome performances was prepared, reviewed and compared to the estimated patterns of performance.
4. This report and the recommendations from the study team for improving patient outcomes were evaluated and accepted by the Quality Assurance Board.
5. The Quality Assurance Board evaluated the utility of the health accounting methodology in a rehabilitation setting and institutionalized it as an ongoing administrative function of the department.

APPLICABILITY: The development of an evaluation method that is both relevant and implementable will serve as a basis for improvement of services in a rehabilitation setting and will provide objective justification for the high financial investment in such services. Ultimately, both of these results would lead to better patient outcomes.

040 A Study of the Development and Change of Attitudes of Medical Students Throughout the Time in Medical School

Principal Investigator: FY 1976	Pearl Rosenberg, Ph.D.
Status:	Completed
Dates:	Sept., 1967-Sept. 1974
Cost:	Not included in 1976 budget, project completed in 1975.
Annual Report Reference:	#14, Page 374, R-26

OBJECTIVES:

1. To explore methods by which the clinical attitudes, interests, and involvement of medical students with regard to chronic illness and rehabilitation can be measured and encouraged;
2. to develop a technique to observe, analyze, and document the changes in medical students' attitudes towards patients;
3. to develop teaching techniques to counteract the change from an idealistic, service-oriented freshman to a cynical, self-serving, almost anti-patient senior;
4. to increase the human relations skills of the medical student by increasing his awareness of motivation for behavior in both himself and others;
5. to create a non-defensive channel of communications between faculty and students, whereby an ongoing and immediate critical evaluative analysis is made by students of the medical school program as they are experiencing it, and is given as feedback for faculty planning to aid in curriculum development;
6. to use the technique of group discussion to elicit information regarding the development of professional role behavior in the medical student.
7. to expose both faculty and students to the potential of small group dynamics and the use of the small discussion group as a tool for building more satisfactory student-faculty relationships.

METHODOLOGY:

1. All entering students for the years 1967-70, Experimental Classes I-IV are given a set of aptitude tests. All students in the experimental classes are invited to participate in the project and 45 are selected randomly as experimental subjects. This gives three classes of subjects: experimental, control, and non-participants.

2. Experimental subjects are divided into three groups of 15 who participate in a series of group discussion sessions during their years in medical school. The groups are told they may discuss whatever they wish, and that their evaluations of the medical curriculum would be considered by the curriculum committee but that members of the group would remain anonymous to the administration. Each group session is taped for analysis.
3. In addition to test scores and analysis of group discussion content, data is obtained through evaluation ratings of students by staff and by their peers in the graduating class.

FINDINGS TO DATE:

1. The results of the feedback obtained from the small group discussions had the effect of helping to shape a massive curriculum change which took place prior to the entrance of the last two experimental classes.
2. The data obtained from the group discussions showed students to be preoccupied with three main problems: tension and anxiety about the educational program, its flexibility, competition, extreme demands for rote memory performance, and questionable relevance; the shattering of the self-image by a return to academic schedules, heightened feelings of inadequacy and low status in the medical hierarchy; and reaction to highly charged emotional situations such as life, death, pain, euthanasia, etc. With the "new" curriculum all but the last is changed: there is more self confidence, less concern with academic pressures, and an emphasis on humanism. There is also more free floating anxiety.
3. The results of the attitude tests showed two distinct trends. The two classes who had experienced the "new" curriculum were less adversely affected by the impact of the first two years of medical school than were the two classes of the "old" curriculum.
4. For the Humanitarianism Scale, the two "new" curriculum classes did not decline significantly as did the "old" curriculum classes. For the Cynicism Scale the trend towards a higher mean score was lessened slightly for the "new" curriculum classes.
5. Over the four years there is a trend towards gradually increasing cynicism and decreasing humanitarianism. The trend was arrested significantly for the "new" curriculum classes.
6. The completed Hill-Matrix analysis of group tapes showed that all groups and group leaders were functioning similarly.
7. The Humanitarianism Scale, measuring a unitary construct, was the strongest attitude measure of the three being used.
8. This project a) established small group discussion as a permanent part of the curriculum; b) found that small group discussion can obtain feedback on curriculum and attitudes that is not obtainable by other means; and c) found that a curriculum that de-emphasizes competition and grades has a less negative impact on medical student attitudes.

APPLICABILITY: The process developed in this study is effective in the evaluation and improvement of the medical school curriculum and can help bring about educational and experimental programs that produce more person-oriented and community-oriented physicians.

041 Sexual Function in Physical Disability

Principal Investigator:	Theodore Cole, M.D.	
FY 1976		
Status:	Completed	
Dates:	August, 1971-December, 1975	
Cost:	Annual $34,718	Projected Total $150,000
	RT Annual $10,184	RT % of Annual Total 29%
Annual Report Reference:	#14, Page 249, R-39	

OBJECTIVES:

1. To understand the sexual attitudes and behavior of paraplegics and quadriplegics;
2. to learn in what ways the paraplegic and quadriplegic have problems in expressing their sexuality;
3. to develop methods to solve sexual problems caused by spinal cord injury;
4. to seek ways to make health care professionals aware that they must take the initiative in discussing sexuality as equals with their patients.

METHODOLOGY:

1. Questionnaires are administered to all disabled participants.
2. Personal interaction is conducted with trained interviewers (small group facilitators).
3. Instructional presentation combined with question and answer sessions is made.
4. An environment is created in which sex issues can be presented in understandable format by medical and nonmedical people, using slides, movies and lecture.
5. A comfortable and safe setting is provided for the participants to discuss their feelings about human sexuality and to learn about sexual attitudes and behaviors.

FINDINGS TO DATE:

1. Physically disabled college students found this methodology personally beneficial.
2. The National Paraplegia Foundation co-sponsored a subscription of a number of participants who provided 65 positive evaluations of the usefulness of this methodology to physically disabled adults and their partners.
3. Requests for advice, research findings, and audiovisual material was received last year from approximately 50 health care facilities in the U.S. Numerous inquiries were also received from foreign countries
4. In 1973, 95 questionnaires were mailed to spinal injured adults and their partners who participated in this research project; 70% returned their questionnaires. Tabulation shows that of that number 95% reported they were glad to have participated in the project, 82% reported that involvement in the project was personally beneficial to them, and 89% stated that they could recommend involvement in a similar project to other people with disabilities similar to their own.
5. Over 20 publications have been completed, submitted and/or accepted to national publications.
6. Seven half-hour video tapes dealing with sexuality and physical disability have been professionally made for commercial distribution.
7. Eight 16 mm sound movies have been made for educational purposes.

APPLICABILITY: Persons with spinal cord injury are becoming less content to lead lives affected by the myths commonly believed by many medical personnel and others in society. These myths deny them a satisfactory sex life, a respectable self-image, and the expectation of being treated like other people who have a need for emotional and sexual expression. By increasing understanding of sexual attitudes on the part of both patients and rehabilitation personnel, this project will help paraplegics and quadriplegics to develop a more satisfactory sex life and more successful personal adjustment.

042 Development of a Systematic Problem Solving Approach to the Practice of Rehabilitation Medicine

Principal Investigator:	**Theodore Cole, M.D.**
FY 1977	
Status:	**Completed**
Dates:	**January, 1972-June, 1976**
Cost:	**Not included in 1977 budget, project completed in 1976**
Annual Report Reference:	**#15, Page 234, R-45**

OBJECTIVES:

1. To develop a system of recording components of the problem-solving practice of rehabilitation medicine which involves participation by all of the rehabilitation professions and services participating in the program.
2. To develop a systematic, standardized code of rehabilitation problems handled in a general rehabilitation center.
3. To develop methods to facilitate interdisciplinary communication of the rehabilitation team.
4. To identify obstacles to the delivery of related services which are necessary for the solution of a patient's problems during rehabilitation.
5. To develop a computer program which produces pertinent data on the problem-solving approach to the practice of rehabilitation medicine so that efficiency and efficacy of problem resolution can be measured and improved.
6. To study some of the determinants of cost of solving rehabilitation problems.

METHODOLOGY:

1. The development of a system for making pertinent entries in the hospital record by all members of the rehabilitation team.
2. To develop a standardized list of problems commonly encountered in a rehabilitation setting.
3. To train the staff of a rehabilitation center to use the problem-oriented methodology and standardized list of problems.
4. To develop a system of uniform documentation of the response of the patient and his problems to the efforts of the treatment team.
5. To develop a system of patient outcome analysis.
6. Tabulation and analysis of hospital cost data.

FINDINGS TO DATE:

1. A problem oriented medical record was developed and refined.
2. The problem oriented medical record was applied to the rehabilitation setting.
3. A procedure manual was developed to standardize record keeping.
4. The procedure manual for record keeping was updated.
5. The list of standard terminology for problem oriented medical records was developed.
6. The standard terminology list was refined, miniaturized, and distributed.
7. Conformity among the rehabilitation staff was audited for utilization of the procedures.
8. A system for measuring patient status following rehabilitation was selected.
9. The staff was trained to utilize this system on the adult and pediatric stations.
10. The first sample of problem status was tabulated before and after rehabilitation treatment of adult inpatients.

APPLICABILITY: The problems being addressed by this project are the disorganized, non-system of medical record keeping and the haphazard diagnosis oriented system of process rather than outcomes oriented therapeutic effort. The expected outcome of the project is to create a system of problem solving which is systematic and responsive to rehabilitation needs of patients. These methodologies should lead to the development of new record keeping forms which should be applicable to other rehabilitation facilities. Administrators and policy makers should find these pertinent to their need to cost account the rehabilitation effort and relate the outcomes to process. The users of this research should be professionals at comprehensive rehabilitation facilities throughout the country. Ultimately, of course, the benefit falls to the patient and the fiscal intermediary who assumes financial responsibility of his health care.

043 A Study of the Muscle Spindle of the Human Tongue Muscle

Principal Investigator:	**Ali Turkyilmaz Ozel, M.D.**
FY 1977	
Status:	**Completed**
Dates:	**May, 1974-June, 1976**
Costs:	**Not included in 1977 budget, project completed in 1976.**
Annual Report Reference:	**#15, Page 242, R-55**

OBJECTIVES:

1. To provide data on the structure and ultrastructure of the muscle spindle of the human tongue;
2. to compare the structure and ultrastructure of the muscle spindle of the human tongue with the spindle of the limb and trunk muscles;
3. to study the innervation of the human muscle spindle in the tongue;
4. to study the effects of stimulation of muscle spindle on the function of the human tongue; and
5. to attempt to develop an explanation about feedback control of the coordinated motion of the human tongue.

METHODOLOGY: Several adult, child, newborn, and stillborn human tongues will be obtained from cadavers, fixed in formalin, imbedded in paraffin, and sectioned completely. Slides will be processed for: hematoxylin and eosin staining to study intrafusal and extrafusal in the muscle fibers, silver staining to study the neural innervation, and osmium staining to study the ultrastructure by electron microscope. EMG studies will be done on the intrinsic and extrinsic lingual muscles of normal, cerebral palsied, and hemiplegic subjects.

FINDINGS TO DATE: The location and structure of muscle spindles were studied in two adult human tongues. Typical muscle spindles were identified in the superior longitudinal, inferior longitudinal, and transverse and vertical intrinsic muscles of the tongue, as well as in the genioglossus, styloglossus, and hypoglossus extrinsic muscles of the tongue. The morphology of the lingual muscle spindles was carefully studied in detail. The reflex function of the tongue was studied electromyographically. Spontaneous motor unit activity was detected in the intrinsic tongue muscles of all five subjects at rest. EMG studies were also done on a C-2 quadriplegic patient. Spontaneous motor activity could not be detected in the intrinsic tongue muscles of this subject.

Previous literature presented similar results in animal experiments and shows the existence of afferent fibers from the distal part of the hypoglossal nerve to the brain vial C2 and C3 dorsal roots. Based on this literature and the findings of the present work, the investigator concluded that the main function of the lingual muscle spindle might be the facilitation of the voluntary movement of the tongue. The hypothesis which attributes the proprioceptive role to the human muscle spindle was also found reasonable, but needs more evidence before acceptance.

APPLICABILITY: The data on the structure and function of the muscle spindle of the tongue will lead to better understanding of the motor behavior of the human tongue, and hence to the establishment of new techniques for the training of the tongues of cerebral palsied and other brain-damaged patients with speech defects. These training techniques may lead to the solution of nutrition and speech problems in patients with brain damage.

The living expense of the patients who have difficulty in eating, secondary to the lack of tongue control, is always higher in institutions, since they need special care and special foods for feeding. Also, difficulty in communication causes time wasting as well as time delay, to solve many patients' problems and increases the expenses.

044 Community-Based Growth Group for Disabled Persons

Principal Investigator:	Nancy M. Crewe, Ph.D.
FY 1976	
Status:	Completed
Dates:	Sept., 1974-Sept., 1975
Cost:	Not included in 1976 budget, project completed in 1975
Annual Report Reference:	#14, Page 383, R-56

OBJECTIVES:

1. To reduce the personal and social isolation of homebound persons with severe physical disability;
2. to increase the frequency with which participants engage in productive activity, are active in an organization, leave their living quarters, form friendships, become involved in dating or sexual relationships.

METHODOLOGY:

1. The candidates for the group were nominated by the public health nurse and interviewed in their homes by the two group leaders and the nurse.
2. Weekly group meetings were held in the North Community School. Participants were transported by Wheels of Wonder.
3. Group meetings were structured to some degree. Leaders and participants determined areas of concern, and occasional exercises were used.
4. Considerable attention was given to sexual attitudes. The project explored the possibility that participants can accept their physical and sexual selves, allowing them more personal and social relationships and increasing their productive activity.
5. Data was gathered at the home interview, the first group meeting, and at three and six month followups. A psychometric measure of self-esteem was administered at the first meeting.

FINDINGS TO DATE:

1. The project has been completed.
2. Attending the Sexual Attitude Reassessment workshop sponsored by the University of Minnesota Medical School was important in achieving the growth that was seen in most participants.
3. The participants made progress toward their individual goals. Though the group was not the only force responsible for these changes, the anecdotal evidence for the value of the group is strong.
4. Because the group was so small statistical analyses were not valid. The assessment was focused on behavioral goals and changes.
5. The DVR was eager to extend this experience to their clients.

APPLICABILITY: The severely disabled person whose quality of life is enhanced and self-esteem is raised can become a viable member of the community. Societal rewards will be realized by the increased payment of taxes by the disabled worker, and increased involvement in community and social activities, with less need of welfare and medical assistance and more total involvement in society in general.

045 Studies of Urologic Function in Patients Following Spinal Cord Injuries

Principal Investigator:	Mary Price, M.D.	
FY 1976		
Status:	Continuing	
Dates:	October, 1963-October, 1978	
Cost:	Annual $191,189 RT Annual $131,530	Projected Total $790,000 RT % of Annual Total 69%
Annual Report Reference:	#14, Page 63, R-2	
FY 1977		
Status:	**Continuing**	
Dates:	**October, 1963-October, 1978**	
Cost:	**Annual $199,220** **RT Annual $135,405**	**Projected Total $790,000** **RT % of Annual Total 68%**
Annual Report Reference:	**#15, Page 29, R-2**	

PART I

OBJECTIVES:

1. To study renal function and micturition and their relationship to recurrent bladder infection in patients with spinal cord injury;
2. to test methods for improvement of urinary bladder function and management in patients with spinal cord injury;
3. to record the changes of urinary tract function of paraplegic and quadriplegic patients over a period of time.

METHODOLOGY:

1. Renal function is tested by blood and urine analyses after intravenous injection of insulin and para-amino hippurate.
2. The mechanism of urination is studied by air-cystometry, clinical analysis, and radiographic techniques. In catheter-free patients, the amount of urine remaining in the bladder after voiding is measured.
3. Urine culture results and the patient's history of bladder infections are correlated with the findings of the preceding studies.
4. Prediction of the control of bladder contractility is attempted through the use of the urecholine denervation super-sensitivity tests.

FINDINGS TO DATE:

1. Sister Kenny Institute patients have withdrawn from this project because of staffing and transportation difficulties.

2. With the approval of the Federal Drug Administration the Renal Function Laboratory was chosen by Arnar-Stone Laboratories to compare the efficiency of the modified form of inulin with the older form of inulin in testing glomerular filtration rate. The two substances compared closely with each other. The FDA has approved the inulin, except for the written material to accompany the vials.
3. Because of the inulin shortage, only 49 patients have received renal function tests.
4. Studies of micturition, particularly using the Merril Gas Cystometer, have been augmented.
5. The data from the past ten years was analyzed and information was disseminated.

APPLICABILITY: Preliminary reviews of systematic, ongoing evaluations of spinal cord injury, indicate that urinary tract deterioration is not inevitable and that funds spent in training patients' physicians, paramedical personnel, and the families of patients in their proper care will result in a great saving of funds formerly spent as a result of the treatment of physical and psychological deterioration.

PART II

OBJECTIVE: To determine change of renal function in paraplegic and quadriplegic patients who have required ileac diversion.

METHODOLOGY: Studies of renal function as outlined in Part I are carried out immediately before diversion and annually thereafter.

FINDINGS TO DATE: A doctoral thesis is being prepared that will demonstrate that while the mean value of annual rate of change of the total population of our study shows slight improvement of function annually, the mean value for annual rate of change of patients with ileac diversions is somewhat better than the mean value of the entire group. Regression lines showing change of function prior to diversion in comparison with change of function after ileal diversion are being prepared. The doctoral candidate preparing the results was forced to postpone the completion of his work.

APPLICABILITY: The surgical procedure, ileac diversion, is being more frequently performed to avoid kidney deterioration resulting from poor kidney drainage. There is need for objective evidence regarding the efficacy of this procedure.

PART III

Discontinued

PART IV

OBJECTIVES: To compile a comprehensive bibliography of the world literature concerning the urinary tract function of patients with spinal cord injury, emphasizing especially the pathophysiology of the urinary tract, laboratory methods for diagnosis and statistical methods of documentation.

METHODOLOGY: Medline, Medlars, and manual search techniques are being used. Primary reference cards are made for 70 subtopics with cross referencing. These have been catalogued.

FINDINGS TO DATE: As of FY 1976, 10,477 references are filed, with an additional 7,967 cross references, and 11,221 authors listed. Members of the laboratory have read 4,610 of the references.

As of FY 1977, 11,301 primary references are filed with an additional 8,305 cross references and 11,913 authors listed. Members of the laboratory have read 5,232 of the references.

APPLICABILITY: Through the bibliography it has been possible to improve research techniques and to apply therapeutic findings to patient treatment.

PART V

OBJECTIVE: To accumulate data for future study of the relationship of immunological processes to urinary tract infection.

METHODOLOGY: Electrophoretic patterns of serum proteins are obtained for each patient receiving a urinary tract evaluation.

FINDINGS TO DATE: Preliminary reports indicate some abnormality of electrophoretic pattern in more than one fourth of the patient tests. Twelve percent showed decreased total serum protein. In the globulin fraction the greatest number of abnormalities was found in Alpha 2, followed by Gamma, Alpha 1, and Beta, in that order. Current efforts are being made to correlate the abnormalities found with evidence of upper-tract infection as indicated by calyceal blunting.

APPLICABILITY: Since urinary tract infections are prevalent in patients with spinal cord injuries, treatment of these infections, aided by the determination of immunological changes in the blood, would significantly aid in the rehabilitation and maintenance of rehabilitation of these patients.

PART VI

OBJECTIVE: To document changes in bladder contractility through the use of the Merrill Air Cystometer.

METHODOLOGY: The air cystometer is used to record changes in bladder pressure at weekly or bi-weekly intervals for inpatients and at the time of return visits by outpatients.

FINDINGS TO DATE: During FY 1976, One hundred seventy-two gas cystometrograms were made, together with 31 denervation and supersensitivity tests, utilizing Urecholine. The gas cystometrogram was used for education for trial of voiding for 16 patients.

During FY 1977, One hundred forty-two gas cystometrograms were made, together with 25 denervation and supersensitivity tests, utilizing Urecholine. The gas cystometrogram was used for education for trial of voiding for 20 patients.

APPLICABILITY: The results of this story will aid in improving patient care through the more accurate assessment of the value of cholinergic and symphatomimetic drugs in augmenting or depressing bladder contractibility, through the determination of length of period of spinal shock, through predictions of the success of trials of voiding, and through the correlation of the level of spinal cord injury with the changes of pattern contractility.

PART VII

OBJECTIVE: To utilize the pool of quadriplegic and paraplegic patients cared for by the Sister Kenny Institute in compiling a record of renal function changes over a number of years in patients with spinal cord injury.

METHODOLOGY: Evaluations of spinal cord injured patients described in the preceding parts of this study will be compared via computer at the end of the first 10 years of the project in October 1973.

FINDINGS TO DATE: This part has been discontinued because of staffing and transportation difficulties. Analysis of data revealed that the Sister Kenny Institute inpatients had lower mean values for renal function than University of Minnesota Hospitals inpatients.

APPLICABILITY: This program has increased the quality of patient self-care and has educated the rehabilitation staff concerning the positive and negative aspects of conventional rehabilitation techniques.

PART VIII

Discontinued

PART IX

OBJECTIVES:

1. To assess the efficacy of a telescopic double lumen catheter in minimizing contamination of urine obtained for culture from the ileal conduit;
2. to establish a reliable method for obtaining urine cultures from patients with ileac diversions.

METHODOLOGY: Urine is obtained for culture by inserting a double lumen catheter into the ileal conduit and by sterile swab from the stoma.

FINDINGS TO DATE:

1. A telescopic double lumen catheter has been used to obtain urine speciments from 101 patients with ileac diversions. Urine culture from the ileal loops of 23 patients showed no growth; 28 cultures showed growth with from 1 to 6 different species of microorganisms: 55% of positive urine cultures grew more than one organism. Urine cultures from the loops of 23 patients showed no growth, even though the stoma swab from the same patients indicated the presence of up to nine different species of microorganisms on the area surrounding the opening to the loop.
2. These studies indicate that the double lumen catheter method of obtaining urine culture specimens presents a reliable method of determining ileal loop infection and avoids the possibility of contamination as the catheter is inserted through the stoma.
3. This procedure has been incorporated into routine procedures for evaluating the renal function of patients with ileac diversions.
4. Results indicate that improper care of the ileostomy and appliance is a possible source of infection because bacteria may be introduced into the ileal loop and subsequently to the kidneys from a contaminated stoma or collection bag. An illustrated manual was prepared after observation of patient care, both in and out of the hospital, indicating the need for a more explicit educational program for both patients and attendants.

APPLICABILITY: The use of the double lumen catheterization procedure may provide a method of obtaining urine specimens free from contamination as the catheter is inserted through the stoma.

PART X

OBJECTIVES:

1. To study the sources of urinary tract infections in patients with ileac diversions;
2. to determine the extent of bacterial flora present in the ileal loop at the time of diversion and to establish if this bacterial flora plays a part in subsequent infections;
3. to determine if post diversion infections are related to prediversion urinary tract infections;
4. to determine possible sources of postdiversion reinfections.

METHODOLOGY:

1. Aerobic and anaerobic cultures are made from a section of the ileal wall and both ureters at the time of ileac diversion. Urine cultures are made before the operation and serially following the operation.
2. Antibiotic sensitivity tests are made on all organisms present and organisms are saved for future study.

FINDINGS TO DATE:

1. During FY 1976, thirteen patients with recurrent urinary tract infections exhibiting no fewer than two organisms isolated by urine culture have been followed since before their diversions.

   At the time of division cultures were made from sections of the ilecum (9 had bacterial growth, four did not), the right ureter (seven had bacterial growth, five did not), and the left ureter (five had growth, seven had no growth and one was lost).

   There has been no correlation between organisms found in the tissue cultures and those found in the postdiversion urine cultures.

   Results indicate the improper care of ileostomy and appliance is a possible source of infection.
2. During FY 1977, ten patients with recurrent urinary tract infections exhibiting no fewer than two organisms isolated by urine culture have been followed since before their diversions.

   At the time of diversion cultures were made from sections of the ileum (12 had bacterial growth, 7 did not), the right ureter (11 had bacterial growth, 8 did not), and the left ureter (8 had growth, 9 had no growth and 2 were lost).

   There has been no correlation between organisms found in the tissue cultures and those found in the post diversion urine cultures.

   Results indicate that improper care of ileostomy and appliance is a possible source of infection.

APPLICABILITY: The incidence of bacteriuria in spinal cord injured patients with ileac diversion has remained high. It is important to evaluate the possible reasons for this high incidence of bacteriuria and to establish procedures of care and medical management that will help eliminate urinary tract infection.

PART XI

OBJECTIVE: To determine the predictable normal annual variation of glomerular filtration rate, renal plasma flow, and tubular excretion of individual patients.

METHODOLOGY: A least-squares regression line is plotted using successive test values following the third evaluation of each patient.

FINDINGS TO DATE: Following the publication of a doctoral thesis, results of the analysis will be available.

APPLICABILITY: This study will provide the first documented data regarding the yearly fluctuations of function. This knowledge will provide physicians with guidelines for assessing the clinical importance of changing rates of glomerular filtration rate, renal plasma flow, and tubular excretion in a given patient.

PART XII

OBJECTIVES:

1. To implement a program of patient instruction and training in the care of the urinary tract and urinary collecting devices, emphasizing the importance of maintaining optimal kidney function from the beginning of acute care of the patient following spinal cord injury;
2. to assess the understanding of the patient regarding urinary tract care prior to his leaving the hospital;
3. to assess the value of this program in preventing urinary tract infections and in maintaining renal function by comparing information obtained at periodic followup of these patients with data from patients not exposed to this program.

METHODOLOGY:

1. Educational material has been prepared and will be given to each spinal cord injured person after admission to the hospital.
2. The staff will check off, date, and sign each subject after it has been discussed.
3. The patient will be tested before discharge. Any remedial education necessary will be done at that time.
4. An effort will be made to include families and attendants in the educational program.

FINDINGS TO DATE: The materials for this patient education program have been developed.

APPLICABILITY: A patient who has adequate understanding of his urinary tract and the methods of caring for it will have less medical-hospital expense and morbidity. The patient will benefit financially, socially, and vocationally.

046 Study of Cardiac Work Evaluation and Reconditioning After Myocardial Infarction

Principal Investigator:	William G. Kubicek, Ph.D.	
FY 1976		
Status:	Continuing	
Dates:	September, 1972-December 1978	
Cost:	Annual $65,072 RT Annual $56,051	Projected Total $500,000 RT % of Annual Total 86%
Annual Report Reference:	#14, Page 132, R-5	
FY 1977		
Status:	**Continuing**	
Dates:	**Sept., 1972-December, 1978**	
Cost:	**Annual $84,173** **RT Annual $64,434**	**Projected Total $500,000** **RT % of Annual Total 77%**
Annual Report Reference:	**#15, Page 49, R-5**	

OBJECTIVE:

1. To study the hemodynamic parameters involved after acute myocardial infarction;
2. to study the response of the damaged heart to exercise and stress testing at mild and moderate energy expenditure in early post-myocardial infarction patients;
3. to investigate correlation of the electrocardiograph changes and the cardiac function as recorded from the impedance cardiograph during exercise stress testing in the early subacute stage, at 21 days, and after 3 months or more; and
4. to determine whether the Impedance Cardiograph and electrocardiograph monitoring of graded exercise tests can be used to establish the safe level of patient performance and progressively test the patient until he or she has demonstrated adequate physical capacity to leave the hospital.

METHODOLOGY:

1. The Minnesota cardiograph and a multilead electrocardiograph are used to monitor patients exercising at various levels of exertion, ranging from mild exercise in the early convalescent phase to moderately strenuous bicycle ergometer or treadmill exercise in the post-discharge period.
2. ECG tracings are compared with several parameters calculated from the impedance cardiograph output. These include the total thoracic impedance, stroke volume, heart rate, cardiac output, and various parameters related to cardiac contractility. These measurements provide an indication of the response to the heart to a demand to pump more blood, as in exercise stress testing.

3. Recently a new laboratory for cardiac and metabolic function has been installed at the University of Minnesota Hospitals. This laboratory provides research capability for complete cardiac and metabolic evaluation. The laboratory has the following list of equipment:
   a. an automated Medical Systems PFA-5 mass spectrometer system for metabolic function analysis,
   b. a model 304A impedance cardiograph,
   c. a Quinton-Monark model QI-870 electrically controlled bicycle ergometer,
   d. a Quinton model 18-49-CI electrically controlled treadmill,
   e. a Gould model 2400 three-channel analog recorder for use with the impedance cardiograph,
   f. Gould model 481 eight-channel analog recorder for use with mass spectrometer system,
   g. Physio-Control series 70DC defibrillator,
   h. Marquette automatic electrocardiograph model 3300, and
   i. Decwriter connected via telephone with UCC for the input of data into computer storage and calculations.

FINDINGS TO DATE: Both impedance studies and pulmonary function studies have been performed in the cardiac rehabilitation program underway at St. Mary's Hospital. The most strenuous exercise was the progressive exercise stress test. In order to aid in data processing and to decrease the amount of time needed to return the results of the tests to the patient and physician, an interactive computer program was developed. Improvements to the system during FY 1976 resulted in increased reliability and decreased operator time. Improvements in the pulmonary function analyzer system has resulted in increased stability and decreased complexity of operation.

The data on 65 coronary care (MI) patients indicate a clear picture of the value of exercise stress testing. In this study, the impedance cardiograph, developed at the University of Minnesota, was used as a separate test for the function of the heart during exercise. Simultaneously, a program of analyzing the ECG, target pulse rate, and clinical symptoms such as chest pain was used separately by the St. Mary's Rehabilitation staff. The patients were categorized into one of four classes using the Functional and Therapeutic Classifications of Patients with Diseases of the Heart (New York Heart Association). The Class I functional test indicates essentially a normally functioning person with known heart disease. The Class II and Class III categories do show some impairment in function, but not sufficiently severe to limit participation in a gainful occupation. Class IV is indicative of very severe cardiac disease.

Of the 34 patients who passed both tests, none was dead 18 months to 2 years later. Also, no patients were placed in Class IV. Those who passed the University test but failed St. Mary's test showed 17 percent dead, 33 percent in class I, 42 percent in class II, none in class III but 8 percent in class IV. Ten failed the University of Minnesota test, but passed the St. Mary's test. Again, 20 percent had died during the evaluation period. Thirty percent were in class I, 40 percent in class II, none in class III and 10 percent were in class IV. Nine patients failed BOTH the University of Minnesota and St. Mary's tests. Twenty-two percent died during the 13 months evaluation period. Only 11 percent were in class I and 11 percent in class II, while 55 percent were in the class III evaluation. None was found in class IV.

APPLICABILITY: Problems directly involving the heart can be studied and the status of the patients more accurately assessed, using the Minnesota Impedance Cardiograph. Another field of use is monitoring the amount of fluid in the chest or lungs, such as in congestive heart failure. The third major use of this system is in peripheral vascular disease. Therefore, any doctor treating these patients would have use for the Impedance Cardiograph. The mass spectrometer system is useful for these patients, especially those with cardiopulmonary diseases.

047 Quantitative and Qualitative Evaluation of Muscular Hypertonia in Patients with Central Nervous System Disease

Principal Investigator:	**Daniel Halpern, M.D.**	
FY 1977		
Status:	**Continuing**	
Dates:	**August, 1964-July, 1976**	
Cost:	**Annual $53,901** **RT Annual $41,516**	**Projected Total $180,000** **RT % of Annual Total 77%**
Annual Report Reference:	**#15, Page 70, R-6**	

OBJECTIVES:

1. To develop an apparatus and system to objectively evaluate the character of abnormal muscle tone and the alterations of tone accomplished by various procedures; and
2. to analyze abnormal muscle tone and evaluate therapeutic procedures.

METHODOLOGY: The analytic system is based on the current neurological concept that the muscle spindle, a sensory organ within skeletal muscle, responds to two parameters of elongation, the amount of stretch, and the velocity of the movement. Recordings are made of the force applied and electromyographic activity during a standardized series of passive movements imposed at velocities varying from 3° to 150° per second. Analysis of the data yields quantitative information in the form of a numerical value of the related physical parameter. This system also allows quantitative study of central nervous system activity giving rise to dystonic states that are not mediated by the fusimotor system. By carrying out an analytic procedure that specifically identifies the responsiveness of the skeletal muscle to lengthening and to the velocity of length, not only can these two elements be identified and measured, but the influence of other sources of tone may be measured as well.

FINDINGS TO DATE: During the year 1975-1976, the construction, assembly, and testing of an electrohydraulic automated drive apparatus continued. The capability of rigid velocity control will enable better correlation with other workers in the fields of rehabilitation and neurophysiology, will make examination procedure less arduous, and will enable the examination of large muscle groups of the upper and lower limbs of a greater number of adults. Since the forces necessary to provide the velocity range required are quite high, considerable engineering time has been required to provide safety devices and precautions against patient or staff injury. Interdepartmental cooperation on this project has been provided by the Hydraulics Laboratory of the University of Minnesota Institute of Technology and the Biomedical Computer Sciences Center. The revisions of the program instituted in 1974 have been utilized for the continued evaluation of patients who have been subjects of various therapeutic procedures. Forty-four patients were examined. Three patients were examined prior to, and after, stereotatic brain surgery. In seven patients the effects of medications on muscle tone were evaluated. The actions of the medications are revealed to be more complex than the clinical literature suggests and further studies need to be carried out.

APPLICABILITY: At the present time many procedures for the treatment of patients with muscular hypertonia are being carried out, with little more than subjective judgments as to their validity and continued usefulness. Evaluation of each of these treatment techniques would provide a solid scientific basis for their use, and the objective measures would be worthwhile. Treatment of patients with central nervous system disease would be rendered more effectively, less wastefully, and more economically.

048 Study of the Changes in the Structure, Ultrastructure, Innervation and Enzymes of Skeletal Muscle in Neuromuscular Diseases

Principal Investigator:	**Essam Awad, M.D., Ph.D.**	
FY 1977		
Status:	**Continuing**	
Dates:	**September, 1969-October, 1979**	
Cost:	**Annual $49,350** **RT Annual $36,994**	**Projected Total $300,000** **RT % of Annual Total 75%**
Annual Report Reference:	**#15, Page 81, R-8**	

OBJECTIVES:

1. To study the histopathologic changes occurring in disabling neuromuscular diseases;
2. to study the electrophysiological changes in the neuromuscular system;
3. to study the changes in enzyme activity in these muscles;
4. to identify the specific cause of muscular weakness in individual patients;
5. to improve diagnostic criteria for the neuromuscular diseases that are seen in rehabilitation;
6. to study the ability of human muscle to regenerate as seen in samples taken from patients since the beginning of the project; and
7. to review all the biopsies and enzyme levels of blood samples collected since the beginning of the project.

METHODOLOGY: Patients are evaluated by history, physical examinations, clinical laboratory tests as indicated, and electromyographic and nerve conduction studies. Histopathology of muscle and terminal nerve endings is studied by performing a motor point biopsy to sample the involved muscle(s) and its nerve. The tissue is then processed for: electron microscopic examination of ultrastructure; vital staining with methylene blue to determine the changes in the branches of the intramuscular nerve and the motor end-plates; PAS staining to demonstrate glycogen; toluidine blue staining to demonstrate acid mucopolysaccharides; hematoxyline and eosin staining to demonstrate the structure of the muscle fibers and their nuclei; trichrome staining to evaluate the connective tissue elements in muscle; chemical microanalysis to determine any abnormal constituents in the tissue; review of the biopsy material; and determine the stage of growth or maturation and changes of the cells.

FINDINGS TO DATE: During the past year, the following conditions have been under study:

1. Collagen disease — forty-five patients
2. Fibrositis — six patients
3. Neuropathy — four patients
4. Myopathy — eight patients
5. Muscular dystrophy — one patient
6. Unidentified muscle weakness — ten patients
7. Closed head injury — one patient
8. Normal — four patients

APPLICABILITY: The muscular weakness of many disabled individuals is not clearly understood and needs to be clarified by this research approach, otherwise their rehabilitation will not be complete. As the cases accumulate, the data is analyzed in terms of populations with specific disabilities and their characteristic findings. After studying enough cases in depth, definite conclusions may be drawn that will enable the practicing physicians to identify and analyze the patient's disability and place the patient in the proper perspective.

049 Training Program for Upper Extremity Activities in Athetoid Patients

Principal Investigator:	**Daniel Halpern, M.D.**	
FY 1977		
Status:	**Continuing**	
Dates:	**September, 1965-July, 1976**	
Cost:	**Annual $53,404** **RT Annual $43,336**	**Projected Total $200,000** **RT % of Annual Total 81%**
Annual Report Reference:	**#15, Page 87, R-14**	

OBJECTIVES:

1. To develop an experimental design and technology to evaluate therapeutic method used in cerebral palsy that will be specific enough to measure difference between methods;
2. to identify elements of neuromuscular function that are important in the development of manual coordination;
3. to test the effectiveness of specific component procedures presently available to develop improved coordination in upper extremities of athetoid patients;

4. to develop a series of procedures to train manual coordination, based on neurophysiologic concepts of motor learning that have been shown experimentally to have therapeutic validity;
5. to develop, by using quantitative evaluation techniques for motor coordination, a method that identifies the specific limitations, or the level of coordination that represents a maximum level of performance in an athetoid patient.

METHODOLOGY: Adult patients acted as their own controls. The effectiveness of the training methods was tested by comparing rates of learning during a given time period. Evaluation was done by attaching battery powered small lights to the hand, wrist, and arm of the patient. Still photographs were then taken by a camera with the shutter open. The resulting data indicated direction, range, tortuosity, regularity of rate, and speed. Half of the group was scheduled into an EXPERIMENTAL-CONTROL-EXPERIMENTAL training sequence, and the other half into a CONTROL-EXPERIMENTAL-CONTROL sequence. More accurate observations were made in this way. The photographic data was recorded by computer. During this past year, the table that allowed electromechanical digitization of the localization of the coordinates of the projected image was constructed, standardized, calibrated, and made operational.

FINDINGS TO DATE: A preliminary analysis of the **Inhibition** and **Control** manual skill training programs, described in last year's report, was done. The **Inhibition** program was inferior to the **Control** program, but the **Control** program was more effective when it followed the **Inhibition** program. Learning occurred in both training programs. A methodologic and theoretical approach has been developed to deal with variable individual performance in a way that can arrive at meaningful conclusions in a natural clinical setting. The results of previous studies can now be calculated in a totally objective manner by using computer programs. Some components, such as tortuosity and velocity control, still need further study to achieve objective evaluations. Computer programs are now being established to measure these values for each test performance and convert them to the scoring system for the parameters of motion previously established. Another important study has used electromyographic activity as feedback for training single muscle control in adult hemiplegic patients. Ten patients were trained using alternating electromyographic biofeedback and physical therapy. Biofeedback is not a therapy, but a stimulus modality. Many variables affect the success of this combination of therapies.

APPLICABILITY: The public, the medical profession, the rehabilitation therapies, and the education profession are engulfed in a morass of opinions, relating to all systems of therapy for cerebral palsy. A clear definition of valid therapeutic principles would improve the function of handicapped patients, relieve the frustrations of their families, prevent wasteful expenditure, and provide a common realistic body of thought among professionals. The identification of the feedback parameters and sensory avenues for monitoring performance that are most effective for motor learning should be a direct consequence of an extended series of investigations using this procedure.

050 Quantitative Studies of Muscular Strength and Muscular Work

Principal Investigator:	Martin Mundale, R.P.T.	
FY 1976		
Status:	Continuing	
Dates:	August, 1963-Sept., 1976	
Cost:	Annual $14,315 RT Annual $8,465	Projected Total $230,000 RT % of Annual Total 59%
Annual Report Reference:	#14, Page 235, R-18	
FY 1977		
Status:	**Continuing**	
Dates:	**August, 1963-Sept., 1976**	
Cost:	**Annual $2,717** **RT Annual $722**	**Projected Total $230,000** **RT % of Annual Total 27%**
Annual Report Reference:	**#15, Page 98, R-18**	

OBJECTIVES:

1. To study the strength and power required for functional activities;
2. to evaluate the muscular function of patients prior to surgery and therapy and to evaluate strength and endurance;
3. to provide experience for medical students, medical residents, and physical therapy students in quantitative methods employed to evaluate strength and endurance.

METHODOLOGY: Transducers and electronic recording equipment are used to test the strength of various muscle groups. Testing has been standardized for hip flexion, hip extension, knee flexion, knee extension, ankle plantar flexion, elbow flexion, elbow extension and hand grip. Development of techniques for testing other muscle groups are still under study.

FINDINGS TO DATE: Selected patients are referred to the Kinesiology Laboratory for quantitative muscle testing and specific exercise routines that require quantitative measurement. In 1974, 40 visits were made by 11 patients. All physical therapy students and residents in the PM&R department were given laboratory practice in quantitative muscle testing. During the past year the laboratory has been primarily used for graduate research.

In 1975, 36 visits were made by 7 subjects with a diagnosis of dermatomyositis. All physical therapy students and residents in the PM&R department were given laboratory practice in quantitative muscle testing. During the past year the laboratory has been primarily used for graduate research.

APPLICABILITY: Precise, quantitative techniques for measuring muscular strength during isometric contraction make it possible to localize neurologic deficits and quantitative muscular weakness and to follow the effects of treatment. Repeated measurements of strength are used to monitor the patient's status during treatment which aids in deciding the treatment program.

051 The Evaluation of an Automated Training System for Wheelchair Pushups

Principal Investigator:	Robert Patterson, Ph.D.	
FY 1976		
Status:	Continuing	
Dates:	July, 1971-October, 1976	
Cost:	Annual $25,107 RT Annual $21,953	Projected Total $60,000 RT % of Annual Total 87%
Annual Report Reference:	#14, Page 240, R-34	
FY 1977		
Status:	**Continuing**	
Dates:	**July, 1971-October, 1976**	
Cost:	**Annual $30,520** **RT Annual $21,395**	**Projected Total $60,000** **RT % of Annual Total 70%**
Annual Report Reference:	**#15, Page 101, R-34**	

OBJECTIVES:

1. To investigate the applicability of operant learning procedures in order to establish, in spinal cord injured patients confined to wheelchairs, a pattern of doing push-ups, independent of reminders by staff, for the prevention of ischemic ulcers;
2. to develop a small, light, inexpensive, and reliable battery operated device which will fit in the wheelchair, and signal patients to remind them to perform a wheelchair pushup; ideally the apparatus will also include a numerical counter to count the number of pushups performed during a specified period of time;
3. to compare performance by patients using this apparatus with performances by other patients;
4. to evaluate the language effectiveness of this automated training system in preventing ischemic ulcers.

METHODOLOGY:

1. The apparatus is comprised of a pressure switch, timer, counter, and sound-emitting device. The timer is set to sound a buzzer unless the patient raises himself from the wheelchair at least once during the set period of time. If he does so before the device is activated, the timer will reset. The counter automatically tabulates the number of pushups done by the patient.
2. Paraplegic patients will be assigned randomly to one of two groups; the experimental group will use the apparatus while the control group will be equipped with a counter and timer without a warning device. The number of pushups done by the two groups over a given period of time will be compared.
3. Followup data will be obtained to determine whether the training that occurred by use of the device will continue after the device is removed. Techniques will be developed to allow changing from regular to irregular reinforcement schedules to promote generalization of learned habits beyond the hospital.

FINDINGS TO DATE: The current testing status of the prototype device suggests that it performs satisfactorily and appears to be working well in pre-tests with patients. A device to count the number of wheelchair pushups is still being developed since it presents engineering problems that have not yet been fully solved. The apparatus necessary for the project to carry out its methodology has been developed. The device is being tested on suitable patients as they become available on the Rehabilitation Service. This is to remove "bugs" in the buzzer. Suitable materials are still being tested. A channel has been added to the Control Subject data recorder which indicates the total time the subject was out of the chair.

APPLICABILITY: Skin breakdowns are quite common in patients who have not established patterns, before they leave hospital, of doing pushups independently of reminders. A method to help patients establish the habit of doing pushups would reduce a major cause of morbidity in spinal cord injured patients.

052 Evaluation of Efficacy of Rehabilitation Programs

Principal Investigator:	Frederic J. Kottke, M.D., Ph.D.	
FY 1976		
Status:	Continuing	
Dates:	March, 1972-July, 1977	
Cost:	Annual $111,262	Projected Total $460,000
	RT Annual $86,182	RT % of Annual Total 77%
Annual Report Reference:	#14, Page 266, R-44	
FY 1977		
Status:	**Continuing**	
Dates:	**March, 1972-July, 1977**	
Cost:	**Annual $74,605**	**Projected Total $460,000**
	RT Annual $50,955	**RT % of Annual Total 68%**
Annual Report Reference:	**#15, Page 106, R-44**	

OBJECTIVES:

1. To assess the efficacy of the various types of management as the basis for developing an effective and efficient system of rehabilitation services;
2. to analyze effects of kind, amount, and duration of services on outcome for each major problem category of rehabilitation medicine;
3. to test the recommended management programs on patients.

METHODOLOGY:

1. Data are collected and analyzed by computer from the records of approximately 50,000 patients at the University of Minnesota Rehabilitation Center since 1954.
2. Factors analyzed include status on admission, status at discharge, and qualitative change in such functions as self-care, range of motion, speech strength, intellect, ambulation, homemaking and vocational performance.

3. Followup examination is made of selected stroke patients to analyze adjustment to the community environment and obtain current information on survival, level of performance, degree of dependency, cost of dependency, vocational productivity, impact on family and other social vocational data.

FINDINGS TO DATE: Demographic and rehabilitation data have been entered for 12,000 patients. A data retrieval system providing selective or complete access to this data has been programmed. The data from 1954 through 1974 will be entered. Long term outcomes of rehabilitation will be assessed. The programming of the data for each patient is proceeding: demographic, diagnostic, clinical, therapeutic, prosthetic and orthotics, psychosocial and vocational, and outcome data; all new patients entering the Rehabilitation Center are being entered into this data bank. For patients from previous years the data is being abstracted from rehabilitation records and hospital charts and entered into the data pool. Until the abstra[illegible]g is complete, we are not able to evaluate the total statistics of any one condition but have been working with smaller samples. The evaluation of stroke outcomes continues to test the accuracy of previous estimates. The outcomes evaluation will be extended to other physical disabilities.

APPLICABILITY: Evaluation of the efficacy of rehabilitation procedures and programs of management is essential to place rehabilitation medicine on a sound scientific base and to establish the current state of rehabilitation against which newly proposed methods may be compared.

053 A Followup Study of the Psychological, Social and Vocational Adjustment of Spinal Cord Injured Adults

Principal Investigator:	Gary Athelstan, Ph.D.	
FY 1976		
Status:	Continuing	
Dates:	January, 1973-June, 1976	
Cost:	Annual $47,742	Projected Total $97,500
	RT Annual $32,408	RT % of Annual Total 68%
Annual Report Reference:	#14, Page 305, R-47	

OBJECTIVES:

1. To gather and analyze descriptive data pertaining to the psychological, social, and vocational adjustment of spinal cord injured adults;
2. to develop and define categories of rehabilitation outcomes, including non-vocational outcomes, based upon measures of psychological adjustment;
3. to identify factors relating to rehabilitation outcomes, including such variables as the psychological and social characteristics of spinal cord injured persons and the various treatments they receive, with a special effort to identify variables which can be manipulated to increase the frequency of desired outcomes.

METHODOLOGY:

1. A sample of 228 spinal cord injured patients, followed for up to 10 years in the RT-2 Center, has been identified. All available relevant data on these patients will be tabulated and analyzed for purposes of describing the sample and suggesting hypotheses for further research.
2. Indepth interviews are to be conducted with the spinal cord injured, patients, and members of their families. Specially designed interview schedules and standardized instruments will be used to gather detailed information on the experiences of the subjects and the steps involved in the process of social, psychological, and vocational adjustment to disability.

PROGRESS AND FINDINGS:

1. Three-hundred-thirteen people are the subjects in this study; approximately 35% are employed. They were all sent a "Spinal Cord Injury Study Life Situation Questionnaire." This instrument was specially designed to gather information about living arrangements, educational and employment status, avocational activities, functional abilities, state of health and level of satisfaction with the many different aspects of life and circumstance.
2. At present, preliminary tabulations of the data are just beginning. Thus, it is too early to attempt even a tentative review of the findings. However, we will be able to identify relationships among the above variables which will suggest patterns of adjustment and facilitate the process of establishing

criteria for nonvocational rehabilitation.

3. Within the subject sample there is a tremendous range of levels of social and psychological adjustment among those who are not working and these variations may be related to health and income status.
4. At the same time as the descriptive data from the questionnaire survey are being analyzed, the criteria for analysis are being developed.

APPLICABILITY: Since rehabilitation goals tend to be defined in vocational terms, little attention has been devoted to specifying goals for people who need rehabilitation services but have little or no prospect of vocational rehabilitation, including many severely disabled spinal cord injured patients. Specifically designed psychological and social, as well as vocational objectives will aid in focusing the treatment program for persons with spinal cord injuries. Even for those spinal cord injured persons who are not employable, better personal adjustment may carry economic rewards in terms of increased self-care and lower medical costs.

054 An Atlas of Vocational Histories of Persons with Spinal Cord Injuries

Principal Investigator:	**Nancy Crewe, Ph.D.**	
FY 1977		
Status:	**Continuing**	
Dates:	**July, 1973-December, 1976**	
Cost:	**Annual $16,490** **RT Annual $14,891**	**Projected Total $38,570** **RT % of Annual Total 90%**
Annual Report Reference:	**#15, Page 119, R-48**	

OBJECTIVES:

1. To provide a reference tool, a collection of histories of successfully employed quadriplegics and paraplegics, to aid in the vocational rehabilitation of persons with spinal cord injuries;
2. to provide encouragement and direction to spinal cord injured persons who are considering employment.

METHODOLOGY:

1. The literature relating to employment with spinal cord injury will be reviewed.
2. A large number of persons with spinal cord injury who might be able to contribute to the project will be identified.
3. Potential subjects will be surveyed by mail to determine which persons are employed.
4. An interview schedule which explores many aspects of working including preparation, job seeking experiences, employment duties, satisfactions and frustrations, problems and solutions will be developed and pretested.
5. All subjects who live within a reasonable distance, approximately 200 miles, of University Hospitals will be personally interviewed at home.
6. The original sample will be augmented with the assistance of other research and training and spinal cord injury centers.
7. Out-of-state subjects who are working in jobs not represented in the Minnesota sample will be interviewed by telephone using the same interview schedule.
8. Case histories which combine biographical, psychological, and medical data with a detailed description of the employment achieved by the subjects will be written.
9. All sedentary, indoor jobs listed in the "Selected Characteristics of Occupations" supplement to the "Dictionary of Occupational Titles" will be identified.
10. Several chapters integrating information available in the literature and data gathered through this project will be written.
11. A book for spinal cord injured persons entitled **Possibilities: Employment After Spinal Cord Injury** will be written and published.
12. A handbook for counselors on the employment of spinal cord injured persons will be written.
13. An article reporting research findings on the employment of spinal cord injured people will be written.

FINDINGS TO DATE:

1. Identification and interviewing of subjects for the project has been completed. One hundred and six biographical sketches were written, representing a wide range of occupations. The identity of most subjects was disguised to protect privacy, although we honored the requests of a few subjects who specifically asked that their real names be used.
2. Additional material was written to introduce the work and to integrate previously published material with the information presented in our study.
3. A third section was prepared with the assistance of the Department of Labor. They provided us with a computer tape of their data in "Selected Characteristics of Occupations: A Supplement to the Dictionary of Occupational Titles." We printed out a list of all sedentary occupations which require minimal physical ability apart from speech, sight, and hearing. The resulting list of more than 700 occupations nearly encompasses the universe of jobs which might be appropriate for persons with a severely limiting spinal cord injury.
4. The total manuscript was submitted to the University of Minnesota Press in September, 1976. Their response was favorable, but they observed that it included material for three separate audiences: spinal cord injured persons, counselors, and researchers. They suggested reorganizing the information and developing separate publications aimed at single audiences. A new manuscript has been completed for spinal cord injured consumers which includes the vocational biographies. Titled **Possibilities: Employment After Spinal Cord Injury,** it will be submitted to a publisher in April, 1977. Work is proceeding on the other two manuscripts.

055 An Evaluation of the Relationship of Self-Care Outcomes to Care in the Acute Hospital, the Rehabilitation Center, and to Post-Discharge Level of Function in Stroke Patients

Principal Investigator:	K. Sperling, M.D.	
FY 1976		
Status:	Continuing	
Dates:	October, 1973-September, 1976	
Cost:	Annual $64,530 RT Annual $58,077	Projected Total $162,000 RT % of Annual Total 90%
Annual Report Reference:	#14, Page 317, R-52	
FY 1977		
Status:	**Continuing**	
Dates:	**October, 1973-September, 1977**	
Cost:	**Annual $56,274** **RT Annual $45,864**	**Projected Total $221,000** **RT % of Annual Total 82%**
Annual Report Reference:	**#15, Page 124, R-52**	

OBJECTIVES:

1. To assess the changes in self-care improvement patterns for stroke patients with respect to the patient's contact with the rehabilitation center and the health care institution, and with respect to his post-discharge level of functioning;
2. to evaluate nursing staffing patterns and cost factors of different rehabilitation programs to see whether these factors have a significant influence upon self-care improvement patterns for differentiable subgroups of stroke patients;
3. to investigate post-discharge placement as it relates to self-care improvement levels.

METHODOLOGY:

1. Data are being collected on a total of 214 patients, 127 of whom were admitted to Sister Kenny Institute, the remainder admitted to one of the four local acute hospitals in the study. Self-care evaluations are done at time of admission and discharge as well as weekly in-patient ratings during each patient's stay by the staff rehabilitation nurse.
2. Follow-up data, including self-care ratings by the staff nurse, sociological data, medical treatments since discharge, and post-discharge adjustment are being collected at points 6, 12 and 24 months after discharge.

3. Nursing-staffing patterns will be investigated to assess different self-care recovery patterns as they relate to the characteristics of the nursing staff.
4. Analysis of factors that possibly play a role in determining patient's self-care recovery will be done. These factors include:
    a. Time since onset of stroke to entry into a rehabilitation facility
    b. Length of stay in the acute hospital
    c. Length of stay in the rehabilitation center
    d. Placement after discharge, i.e. home vs. nursing home
    e. Other personality and attitudinal factors

FINDINGS TO DATE:

I. 1. Patients and Self-care ratings (to 3-1-76)

	No. of Patients Studied	No. of Ratings Done In-Patient	1st F-U	2nd F-U
Sister Kenny Institute (S.K.I.)	127	483	28	6
Northwestern Hospital (NW)	28	91	20	2
St. Francis Hospital (SF)	33	99	14	4
St. Lukes Hospital*	9	24	–	–
New Prague Hospital*	5	9	–	–

*St. Lukes and New Prague Hospitals were added in an attempt to increase the number of stroke patients available for study in that type of setting.

2. Selected baseline data (as of 3-1-76)

	Total N	% Male	Mean Age	Length of Stay-Mean	Adm. Self-Care-Mean	Disch. Self-Care-Mean
S.K.I.	117	51%	65.4 yrs.	37.7 da	14.7	19.3
NW	27	22%	74.1 yrs.	49.7 da	11.6	16.2
SF	33	45%	70.7 yrs.	24.8 da	10.4	12.2
ALL	177	46%	67.7 yrs.	37.1 da	13.4	18.0

3. Preliminary findings are:
    a. Length of stay in an acute hospital has little or no impact upon improvement in self-care ability. A high degree of relationship between improvement and length of stay, (r = .70) occurs in the rehabilitation center.
    b. Nursing-staffing patterns are currently undergoing analysis. Findings to date are:

	Mean Staff Hrs./Patient Day	S.D.
Acute Hospitals	5.2 hours	0.8
Rehab Center	7.3 hours	0.7

    c. Not all financial data has been collected, however there is tentative evidence supporting the hypothesis that optimal cost-benefit ratios are obtained when patients with successively higher initial self-care scores are treated in successively higher level rehabilitation treatment programs.

II. 1. Patients and Self-Care Ratings (to 3-21-77)

	No. of Pts. Studied	Number of Ratings Done In-Patient	1st F-U	2nd F-U	3rd F-U	EXP.
Sister Kenny Institute (S.K.I.)	127	492	76	23	6	23
Northwestern Hospital (NW)	28	91	20	15	–	10
St. Lukes Hospital	9	24	7	2	–	1
St. Francis Hospital (SF)	43	108	22	12	2	11
New Prague Hospital	7	14	3	–	–	2
Totals	214	729	128	52	8	47

2. Hospitalization Costs

Dollar Cost/point of Self-Care Improvement – in Hospital

Imp.	N	Ave. L.O.S.	Ave. $/pt.	Ave. $/pt. day	Ave. S-C Imp.	Ave. $/S-C
St. Francis	22	21.8	$2,435	$112	2.825 pts.	$ 862
Northwestern	14	42.1	$4,868	116	4.556 pts.	$1068
S.K.I.	85	33.7	$4,996	148	4.177 pts.	$1196

3. Follow-Up Data, based on placement at discharge

	Initial Self-Care		Disch. Self-Care		1st Follow-up		2nd Follow-up	
	N	Mean	N	Mean	N	Mean	N	Mean
S.K.I.								
Disch. to Home	29	16.4	29	22.6	29	23.5	11	26.0
Disch. to Nsg. H.	10	12.4	10	21.3	10	17.9	9	15.7
ALL SKI	39	15.4	39	21.7	39	21.9	20	21.3
Northwestern								
Disch. to Home	12	11.4	13	20.2	13	22.5	8	23.8
Disch. to Nsg Home	4	6.8	4	13.5	4	12.4	4	14.6
ALL N.W.	16	10.3	17	18.6	17	20.2	12	20.7
St. Francis								
Disch. to Home	13	11.5	15	19.5	15	25.4	2	19.5
Disch. to Nsg Home	4	7.2	4	7.8	4	15.4	2	12.4
ALL S.F.	17	10.5	19	17.0	19	23.3	4	15.9

St. Lukes and New Prague Hospitals are not included in the above analysis because of small sample sizes.

APPLICABILITY: The results of this study may initiate changes in pre-and post-rehabilitation care. If certain stroke management practices in current use are of greater benefit than others, then changes should evolve in the management of stroke rehabilitation at various levels of patient care.

056 Voluntary Control of Autonomic Processes Using Biofeedback and Reinforcement Procedures

Principal Investigator:	**Alan H. Roberts, Ph.D.**	
FY 1977		
Status:	**Continuing**	
Dates:	**January, 1974-June, 1977**	
Cost:	**Annual $56,507** **RT Annual $33,021**	**Projected Total $75,000** **RT % of Annual Total 58%**
Annual Report Reference:	**#15, Page 130, R-53**	

OBJECTIVES:

1. To conduct a series of experiments which will provide answers to some questions concerning the voluntary control of autonomic functions, especially skin temperature, and the applicability of autonomic learning to the clinical treatment of disabling disorders associated with dysfunction in peripheral circulation;
2. to conduct a series of studies as follows:
   - a) A number of reliable questionnaires relatively free of contaminating variables such as sex, other personality variables, neuroticism and hypochondriasis will be developed by means of orthoginal factor analysis.
   - b) The validity of these scales will be evaluated in the laboratory using a number of psychophysiological measures of autonomic reactivity, autonomic control and autonomic response to stress.
   - c) Scales found to be valid in measuring any or all of these dimensions will be used to select subjects to evaluate their ability to learn to self-regulate skin temperature by means of biofeedback training.
   - d) A double blind control group study will be conducted to evaluate the effectiveness of biofeedback training in the regulation of migraine headaches.
   - e) A double blind control group study will be conducted to evaluate the effectiveness of skin temperature training in controlling Reynaud's disease.
   - f) Paraplegic subjects will be used to evaluate whether or not individuals can learn to self-regulate skin temperature without the use of striate musculature.

METHODOLOGY: Scale construction will use large numbers of normal subjects to identify items related to each other and independent of other relevant variables by means of replicated factor analyses. Other studies will be conducted in the Skin Temperature Regulation Laboratories of the Department of Physical Medicine and Rehabilitation, University of Minnesota, using double blind procedures and control groups as appropriate.

FINDINGS TO DATE:

1. Using over 552 subjects, three scales have been derived by means of orthoginal factor analysis which measure Autonomic Response Frequency (assessing spontaneous fluctuation in autonomic responding), Autonomic Response to Stress (assessing the amount of autonomic arousal perceived by subjects in stressful situations), and Somatic Response Control (a self-report measure of capacity to control both autonomic and fine muscle responses). These scales have been demonstrated to be relatively free of several contaminating personality variables such as neuroticism and hypochondriasis.
2. Subjects scoring high or low on each one of these scales have been evaluated in the laboratory with respect to each of the dimensions presumably measured by these scales. These data have been collected and are currently being analyzed.
3. A double blind, control group study of hand warming training as a method of controlling migraine headaches has been completed. Data are currently being analyzed.
4. A double blind, control group of the effectiveness of skin temperature regulation training in controlling Reynaud's disease is currently in progress. A monograph has been published critically evaluating the evidence concerning the neurogenic versus local fault theories of the etiology of Reynaud's disease. Questionnaire data had been collected on a large number of patients suffering from Reynaud's disease.
5. Paraplegic subjects appropriate for and willing to cooperate in a study to determine whether or not they can learn to control the skin temperature in their paralyzed limbs are presently being located and selected for laboratory study.

APPLICABILITY: These studies should answer, in part, questions concerning whether most people are able to learn voluntary control of autonomic functions or whether this is an ability that only a few people possess. The determination of the mechanisms, parameters and methods for learning autonomic control will contribute to and enhance potentially powerful therapeutic techniques for the treatment and rehabilitation of a wide variety of chronic diseases.

057 An Investigation of Decubitus Ulcer as Manifestation of Psychosocial Problem

Principal Investigator:	**Thomas P. Anderson, M.D.**	
FY 1977		
Status:	**New**	
Dates:	**September, 1975-September, 1977**	
Cost:	**Annual $26,400** **RT Annual $22,502**	**Projected Total $50,952** **RT % of Annual Total 85%**
Annual Report Reference:	**#15, Page 154, R-57**	

OBJECTIVES:

1. To develop a measurement of decubitus ulcers that would reflect the impact of their occurrence on the patient;
2. to identify those psychosocial factors associated with the occurrence of pressure sores;
3. to develop a new program for training patients and health care workers in the prevention of decubitus ulcers.

METHODOLOGY: This study has two stages. The first stage attempted to delineate those psychosocial factors that would predispose an individual to the increased probability of skin ulceration. Differences on three psychosocial measures among 141 spinal cord injured, both inpatients and outpatients, were examined along with their history of decubitus ulcers since the onset of their injury. The psychosocial measures used were the Tennessee Self Concept Scale, a self-report measure of the individual's personal satisfaction with his life activities, and a measure of individual responsibility in skin care. Multiple linear regression was used to determine those factors associated with the variance in incidence of decubitus ulcers.

The second stage will utilize the information gathered from stage one to determine the direction, content, and methods of a new education program. This program will be directed at health care workers and patients to decrease decubitus ulcer incidence.

FINDINGS TO DATE: Data gathered in stage one is currently being evaluated. Definite conclusions and recommendations to determine the direction and content of the skin care program will be reached in the Spring of 1977.

APPLICABILITY: The isolation of some psychosocial aspects of decubitus ulcer incidence will aid in signaling conditions which could predispose a patient to the development of pressure sores. Physicians, DVR counselors, patients and their families can watch for and use these signals.

The development of new programs for teaching skin care hopefully will lower the incidence of decubitus ulcers and their cost.

058 Bibliography of Psychosocial, Vocational, and Sexual Aspects of Spinal Cord Injury

Principal Investigator:	**Gary T. Athelstan, Ph.D.**	
FY 1977		
Status:	**New**	
Dates:	**November, 1975-January, 1981**	
Cost:	**Annual $6,729** **RT Annual $5,250**	**Projected Total $35,855** **RT % of Annual Total 78%**
Annual Report Reference:	**#15, Page 160, R-58**	

OBJECTIVES:

1. To provide a well organized, comprehensive bibliography of all confirmed publications about psychosocial, vocational, and sexual aspects of spinal cord injury;
2. to distribute the bibliography widely, both to justify its development and to facilitate the updating process;
3. to serve as a central contact for the widest possible dissemination of new and existing references to facilitate the rehabilitation service and research in the area.

METHODOLOGY: Letters stating the purpose of the project and requesting copies of any locally produced bibliographies and articles were sent to all regional spinal cord injury centers and member physicians of the American Spinal Injury Association. In addition to the letters, a review of RSA supported research and a standard search of the medical and psychosocial literature was done using the MEDLARS and PASAR computer search systems. The citations in relevant publications were checked and all references were verified. By updating the literature searches every year and including a request for further materials along with the distributed bibliography an up-to-date bibliography will be continually available.

FINDINGS TO DATE: After cross-checking to eliminate duplicated references and those that could not be confirmed, our collection was reduced to 500 separate entries. Each of these was carefully checked for accuracy and to determine authenticity, and a judgment was made about the main focus of the work. On the basis of these judgments, the references were assigned to one or more of four content categories. As a result, we now have approximately 235 references dealing with the psychological aspects of spinal cord injury, 155 with social aspects, 130 with vocational, and 175 with sexual. This total exceeds the count of 500 separate entries because some references provided major treatment of more than one topic and were therefore listed under more than one heading. In addition, because spinal cord injury in sports has emerged as a separate topic of some interest, we developed a cross-index to approximately 40 references under the heading of sports. All of these counts of entries in the separate sections will be finalized in the coming weeks as the typing of the manuscript proceeds.

Approximately 525 copies of the bibliography have been distributed thus far. Letters of announcement were sent to the following types of organizations and institutions:

Veteran Administration Hospitals and Centers
Research and Training Centers
Regional Spinal Cord Injury Care Centers
Private hospitals designated as rehabilitation or spinal cord centers
Complimentary copies were sent to journals in the rehabilitation field
Brochures were distributed at the book fair at the 53rd Annual Session of the American Congress of Rehabilitation Medicine
Easter Seal Societies
Canadian Paraplegia Association branches
Outstanding researchers in the field: Rusk, Guttman, Comarr, etc.
Svenska Centralkommitten for Rehabilitering

In addition to orders received in response to our notices, we also received inquiries from many individuals and institutions, foreign and American, whom we did not notify.

APPLICABILITY: The rapid growth of spinal cord injury rehabilitation programs, the conceptualization and expansion of the regional spinal cord injury centers, and the concommitant increase in research and theoretical publications make a centralized integration of the diffuse knowledge essential for providing maximally effective utilization for rehabilitation and further research. In its present state the literature on psychosocial, vocational, and sexual adjustment to spinal cord injury lacks any integration or organization. The large number of relevant journals and identification of these articles makes a literature review for research difficult, and the individual professional rehabilitation worker cannot even be aware of the current state let alone new developments. The availability of an organized, current bibliography could greatly enhance the service and research applications of this growing body of literature.

059 Validity and Reliability of Health Accounting Method of Quality Assurance in a Rehabilitation Setting

Principal Investigator:	**Thomas P. Anderson, M.D.**	
FY 1977		
Status:	**New**	
Dates:	**October, 1975-September, 1977**	
Cost:	**Annual $32,955**	**Projected Total $50,000**
	RT Annual $20,368	**RT % of Annual Total 65%**
Annual Report Reference:	**#15, Page 164, R-59**	

OBJECTIVES:

1. To consolidate and analyze previous health accounting experience;
2. to evaluate procedural reliability and validity;
3. to examine the impact of health accounting strategy on improving the quality of care;
4. to test the generalizability of the protocol to a rehabilitation outcomes study other than completed stroke;
5. to improve the efficiency of the protocol by incorporating recommendations of the first study team;
6. to institutionalize the protocol by orienting and involving a greater number of department personnel.

METHODOLOGY: The first three objectives will be studied in the following manner. A medical sociologist will analyze the documents, manuals, and forms, and taped discussions of project participants. He will then make recommendations for improving project procedures and instruments. Three new project resources are being developed. The ten care settings will evaluate the validity and reliability of specific health accounting procedures. They will examine priority setting of health topics, outcomes standard setting, and reliability of the outcomes measurements made by the health accountant. The Johns Hopkins staff will analyze and draw conclusions from data from all ten care settings. Participating clinics will be matched with nonparticipating clinics to test the development of a measure of innovativeness.

The last three objectives, carried out only by the University of Minnesota, fulfill the requirement that three topics be studied during the project. An exclusive study team will be selected for each topic, thus involving new department personnel.

FINDINGS TO DATE:

1. Three health problems were chosen for study:
    a) Education for Urinary Tract Infections in Spinal Cord Injured Patients;
    b) Therapeutic Program to Retain Function in Employment Aged Patients with Chronic Low Back Pain; and
    c) Intermuscular Neurolysis and Motor Point Blocks by Physicians on Inpatients and Outpatients with Spasticity. Several new personnel were oriented and study was begun.
2. The Health Accountant attended a seminar on understanding the specific procedures for completing the three health outcomes assessment studies and on coordinating project goals.
3. Dr. Thomas Anderson attended a seminar on the future design and procedural development for completing the outcomes assessment projects of the involved clinics.
4. The Johns Hopkins staff attended the first study design meeting and introduced the protocol for assessment study design. The results of the initial outcomes assessment included both a statistical analysis of the occurrence of bacteriuria in relation to defined health levels and an identification of several problems contributing to the unacceptable rate of bacteria found.
5. A bibliography on Chronic Low Back Pain in Employment Aged Patients was developed and diagnostic and demographic characteristics of the department population were gathered and presented to the study team. The measurement instrument was designed and is currently being tested.
6. A literature review and prevalence statistics were developed in the study of Intermuscular Neurolysis for Inpatients and Outpatients with spasticity. The scale was adjusted to this health problem and initial assessment begun.

APPLICABILITY: An improved and refined system for assessing rehabilitation will 1) focus on outcomes, 2) develop a standard definition of outcomes, and 3) apply to all areas of rehabilitation. Both health professionals and patients will benefit by improved treatment and lower costs of rehabilitation.

060 A Study of the Golgi Tendon Organ in Human Muscles and Tendons

Principal Investigator:	**Rita Bistevins, M.D.**	
FY 1977		
Status:	**New**	
Dates:	**October, 1975-September, 1978**	
Cost:	**Annual $52,234** **RT Annual $44,477**	**Projected Total $100,000** **RT % of Annual Total 85%**
Annual Report Reference:	**#15, Page 184, R-61**	

OBJECTIVES:

1. To study the microscopic structure of the GTO in man;
2. to study the ultrastructure of the GTO in the human by electron microscopy;
3. to study the innervation of the GTO in man;
4. to study the localization of the GTO in man;
5. to study the electrophysiological response of the GTO in man to motion and stretch.

METHODOLOGY: Preliminary work on tissue specimens from autopsy material will establish the technique of localization of the GTO, as well as its gross appearance and structure. Biopsy specimens will be taken from normal muscles from patients undergoing surgical procedures. Localization of the GTO will be attempted by teasing the biopsy specimen under a dissecting microscope and searching for this structure. The tissue will be fixed in formalin, embedded in paraffin and sectioned. The slides will be stained: for hematoxylin and eosin to study the general structure and appearance; silver impregnation to demonstrate the nerve endings and the nerve fibers; and other possible stains as the need may arise. An attempt will be made to study the electrical response of the GTO to motion and/or stretch of the muscle or its tendon, thus stimulating activity in the muscle. A high gain electromyograph will be used for this purpose. This will be carried out on patients with poor muscular control.

FINDINGS TO DATE: The literature search and laboratory work have begun. In the specimens, both encapsulated (paciniform) sensory nerve endings and Ruffini type or classically described GTOs have been encountered. These nerve endings were found within one centimeter of the muscle tendon junction. Other nerve endings were also found, but as this study is concentrated on mechanoreceptors, other nerve structures were sacrificed to preserve the mechanoreceptors.

The microscopic structure was studied by examining teased specimens, microscopic sections, and by using histochemical stains. Seven encapsulated (paciniform) endings have been identified and two of these studied in detail in the ultrastructure study. Good quality electron micrographs have been obtained to demonstrate the structure of the lamellated capsule, inner core cells, and myelinated and nonmyelinated axons of the endings as well as the terminal axon expansions. This is a study of structure, and not a count of sensory endings at the muscle tendon junction. Therefore, only specimens of sufficiently good quality for this purpose will be studied.

APPLICABILITY: Disorders of motor function such as paresis and paralysis with or without spasticity are frequently seen in rehabilitation patients. Better understanding of factors contributing to reflex regulation of motor function is needed. The data resulting from this project will lead to better understanding of the motor behavior and control of muscular motion. This will, in turn, lead to development of better techniques for therapy.

061 Behavior Modification: A Problem-Oriented, Learning-Based Research Strategy for Rehabilitation

Principal Investigator: **Jerry Martin, Ph.D.**
FY 1977
Status: **New**
Dates: **October, 1976-September, 1981**
Cost: **Annual $19,593** **Projected Total $70,000**
RT Annual $9,271 **RT % of Annual Total 47%**
Annual Report Reference: **#15, Page 190, R-62**

OBJECTIVES: To demonstrate the applicability of behavior modification procedures to the improvement of motor functioning of medical rehabilitation patients in physical and occupational therapy.

To evaluate the **long-term** effectiveness of behavior modification on severely handicapped medical rehabilitation patients through reassessment in outpatient follow-up clinics.

METHODOLOGY: Severely handicapped adolescents with cerebral palsy, closed head injuries, and spinal cord injuries who are hospitalized for medical rehabilitation will be included in this study. Behavior modification will be applied as an adjunct in the treatment of specific motor functioning problems. Short term effectiveness will be evaluated through the use of appropriate single-subject research designs. Long-term effectiveness will be evaluated in outpatient follow-up clinics.

FINDINGS TO DATE: Not applicable at this time.

APPLICABILITY: The use of behavior modification in rehabilitation has been limited to a very narrow range of problems. Thus, it is not widely used in comparison to its applications elsewhere. Demonstration of behavior modification effectiveness over a broad spectrum of motor behaviors in the severely handicapped should stimulate other facilities to use these techniques for problems other than management of patient misbehavior.

062 Followup Study of Patients Treated in the Pain Treatment Program, Physical Medicine and Rehabilitation Service, University of Minnesota Hospitals

Principal Investigator: **Alan H. Roberts, Ph.D.**
FY 1977
Status: **New**
Dates: **September, 1976-October, 1977**
Cost: **Annual $31,148** **Projected Total $25,100**
RT Annual $25,802 **RT % of Annual Total 81%**
Annual Report Reference: **#15, Page 195, R-63**

OBJECTIVES:

1. To devise a reliable method for evaluating the overall effectiveness of an inpatient behavior modification treatment program for patients disabled by chronic pain. Measures would include current activity level, interference of pain with activities, medications currently used for pain, daily routine and work activities, and current use of health care services.
2. To determine on the basis of these data the manner in which treatment outcomes can be improved by eliminating, modifying or adding to the treatment program.
3. To improve assessment procedures for evaluating patients for the program so as to select patients most likely to benefit from treatment and reject those likely to fail.

METHODOLOGY: A thorough review of the current literature on pain research will be conducted and the research will be coordinated with other pain treatment programs (cf. Projects R-61 and R-63, University of Washington) in order to enhance the use of current knowledge, avoid duplication and coordinate interviews and questionnaires with data being collected at other treatment centers. Approximately 30 patients admitted to the Pain Treatment Program, 30 patients accepted but not admitted, and 30 patients rejected for treatment will be evaluated by means of a questionnaire and an interview with a social worker or psychologist trained in the evaluation of chronic pain problems. They will also retake the MMPI. Spouse or other significant person in their lives will be evaluated when these individuals were evaluated as part of the initial intake assessment.

FINDINGS TO DATE: Letters and phone calls have been made to subjects randomly selected for study. Questionnaires have been sent out to many of the subjects and interviews and followup evaluations have begun. Short term evaluation of earlier data and data collected so far suggest a "success rate" defined as "leading a normal life relative to age and sex without the use of any prescription pain medications" in the 70-80% range.

APPLICABILITY: The claims of a high rate of successful treatment in behavior modification of pain programs have often motivated chronic pain patients to undertake the difficult and costly inpatient treatment program. Other patients severely disabled by chronic pain are not being referred to pain treatment programs of this type because success rates have not been clearly documented. Documentation of these data is important for future patients, for referring physicians and for those responsible for paying the costs of inpatient treatment as well as the extremely high costs of chronic pain not successfully treated. Specific factors identified as indicating potential for successful treatment will be useful to physicians, insurance companies, vocational rehabilitation personnel and workman's compensation programs in considering the recommending and financing of such treatment for their patients or clients. Identification of factors predicting unsuccessful treatment will also significantly reduce costs.

063 A Portable Exercise Monitoring System for Patients with Coronary Artery Disease

Principal Investigator:	**Turkyilmaz Ozel, M.D.**	
FY 1977		
Status:	**New**	
Dates:	**October, 1975-September, 1980**	
Cost:	**Annual $30,843** **RT Annual $21,235**	**Projected Total $150,000** **RT % of Annual Total 69%**
Annual Report Reference:	**#15, Page 200, R-64**	

OBJECTIVES: To develop a low-cost small, portable device to monitor the exercise level of patients in the cardiac rehabilitation program to use at home, work, or during exercise sessions.

METHODOLOGY: A device will be developed that will monitor the heart rate and emit a signal that will indicate deviations of the heart rate from some preset limits. The device will be made in a small portable package with an earpiece or speaker used for the audio feedback information. The first phase of the project will concentrate on developing the monitoring device, evaluating electrodes, and developing filtering circuits. The second phase of the project will develop arrhythmia detection. Each device will be carried by an appropriate patient with coronary artery disease. Durability, acceptability by the patient and his environment, practicality, and other aspects of the device will also be studied during this period.

FINDINGS TO DATE: A device has been designed that can monitor the heart rate and give a signal indicating deviations of the heart rate for some preset limits. Four such devices have been built. These devices give a beeping tone if the pulse rate is below a certain percent minimum and a steady tone above a preset maximum. In a center region no sound is emitted. The device is small enough to be carried easily. Another system was built in two of these devices. This is a counting device that can total the number of heart beats occurring in each of the three adjustable ranges. A separate read-out box gives the total number of heart beats that have occurred since the last reset time of the pulse counter. This combined device can be used for several purposes: to give audiofeedback information to patients about their physiological level of exercise as measured by the heart rate; to read PACs and PVCs as an increase in heart rate; and to record the total number of heart beats in three adjustable ranges.

The preliminary prototypes in use by patients pose several technical problems. A relatively artifact-free ECG is necessary to monitor the heart rate. Thus, an investigation will be made of six commercially available nondisposable and two disposable electrodes. Also the study will investigate the effects of abrasive skin preparation.

APPLICABILITY: As soon as the device is developed and some technical problems are solved, it can be extensively used by cardiologists for patients with post myocardial infarction. The development of such a device will shorten the hospitalization period, and will enable patients to be reconditioned faster, and return to their previous work.

064 The Value of LDH Isoenzyme Studies in Collagen Disease

Principal Investigator: **A. Turkyilmaz Ozel, M.D.**
FY 1977
Status: **New**
Dates: **September, 1976-October, 1977**
Cost: **Annual $30,527** **Projected Total $24,200**
RT Annual $24,198 **RT % of Annual Total 79%**
Annual Report Reference: **#15, Page 206, R-65**

OBJECTIVES: To determine the relationship between the activity of rheumatoid arthritis and other collagen diseases and the change in the LDH isoenzymes.

METHODOLOGY: Blood will be drawn from patients during the very acute stage of a collagen disease. LDH isoenzymes will be determined by electrophoresis. When a needle biopsy is necessary for diagnostic purposes the tissue will be studied. It will be processed for: electromicroscopic examination of ultrastructure; hematoxylin and eosin staining to demonstrate the structure of the muscle fibers and their nuclei; trichrome staining to evaluate the connective tissue elements in muscle; and chemical microanalysis to determine the change in LDH isoenzymes in the tissue. When aspirational joint effusion is necessary for diagnostic purposes or treatment, LDH electrophoresis will also be done in joint effusion. The [illegible] will be compared to investigate the relationship between the activity of collagen diseases and the change in LDH isoenzymes.

FINDINGS TO DATE: LDH isoenzymes have been determined by electrophoresis on 34 blood samples from 21 patients with rheumatoid arthritis, scleroderma, systemic lupus erythematosis, and dermatomyositis. LDH isoenzyme studies on loose connective tissue has shown that this tissue gives exclusively LD-3 isoenzyme. These findings have supported the original hypothesis that a definite LD-3 isoenzyme occurs during the course of rheumatoid arthritis and other collagen diseases and that this change in LD-3 isoenzyme probably reflects the degree of activity of the disease. In order to show that parallelism between the activity of the disease and LD-3 isoenzyme, a larger number of patients and their followup is necessary. The source of LD-3 isoenzyme is the connective tissue.

APPLICABILITY: Since arthritis may be disabling, its effects on the economy are significant, not only in terms of employment, but also support. Prevention of deformities and disabilities in collagen disease depends on early diagnosis and appropriate treatment. LDH isoenzyme studies seem to have a potential value both in the early diagnosis and the followup of the treatments. Prevention or even delay of disabilities in rheumatoid arthritis and other collagen diseases will certainly make it possible for some of the patients to continue, or return to, their previous jobs.

065 The Effect of Cervical Orthoses on Cervical Spine Motion: A Standardized Radiographic Method of Study

Principal Investigator:	**Steve Fisher, M.D.**	
FY 1977		
Status:	**New**	
Dates:	**October, 1975-March, 1977**	
Cost:	**Annual $6,300** **RT Annual $938**	**Projected Total $9,000** **RT % of Annual Total 15%**
Annual Report Reference:	**#15, Page 211, R-66**	

OBJECTIVES:

1. To study the effects of cervical orthoses on the range of motion of the cervical spine in flexion and extension.
2. To study the range of motion at each given intervertebral level from T1 to the skull in different types of cervical orthoses to obtain data on which orthosis best stabilizes at each individual cervical spine level.
3. To compare the radiographic and bubblegoniometer method of measuring cervical range of motion.

METHODOLOGY: Young adults, ages 20 to 30, served as subjects. Each was fitted and studied in several types of cervical orthoses:

1. The plastic collar with occipital and chin piece
2. The 4-poster collar
3. SOMI collar
4. Plastizote Philadelphia Orthosis

Each individual was fitted by a certified orthotist. Pressure transducers were placed under the chin piece and occipital piece. Each subject was instructed to flex and extend the neck to a given pressure recording. Cervical sagittal spine films were obtained in the neutral flexion and extension position without a cervical orthosis and in each of the orthotic devices. Bubblegoniometric data was also obtained. The data was evaluated by using previously described methods of radiographic measurement.

FINDINGS TO DATE: Please see:

1. Fisher, S. V.; J. F. Bowar; E. A. [illegible]vad; G. Gullickson: Cerv[illegible] Orthosis Effect on Cervical Spine Motion: A Roentgenographic and Goniometric Method of Stud[illegible] Arch Phys Med Rehabil 58:109-115, 1977.
2. Fisher, S. V.: The Effect of Cervical Orthosis on Cervical Range of Motion: A Radiographic and Goniometric Study. M.S. Thesis, University of Minnesota: Minneapolis, Minn., 1976.

Briefly, the 4-poster and SOMI were found to be the most effective orthotic devices in restricting extension and flexion respectively. The polyethylene and plastizote orthoses were significantly less effective in restricting motion. The bubblegoniometer is an adequate clinical tool in assessing overall flexion and extension of the cervical spine but is not as precise and does not give information on the degree of motion at any individual vertebral level. Additionally, the orthotic device fitted more loosely than usual, does not significantly increase the cervical range of motion.

APPLICABILITY: The data of this study can directly be used in the proper prescription as well as fitting of cervical orthotic devices in various pathological conditions. It is suggested that perhaps orthotists should use pressure sensors when fitting braces to obtain the best fit possible within tolerable pressure limits.

066 Development of a Measurement Tool for Placements in Care Facilities

Principal Investigator:	N. Silberberg, Ph.D.	
FY 1976		
Status:	New	[Discontinued in 1977]
Dates:	October 1974-September, 1976	
Cost:	Annual $42,230 RT Annual $38,007	Projected Total $79,000 RT % of Annual Total 90%
Annual Report Reference:	#14, Page 357, R-54	

OBJECTIVES:

1. To develop and refine an instrument for the valid, reliable, and objective measurement of physical functioning that will aid in the larger development of meaningful and useful placement strategies.

METHODOLOGY:

1. The Kenny Self-Care Evaluation will be further refined to measure client levels in activities of daily living.
2. The scoring system will be adapted, making it more useful to a facility not staffed with high level professionals.
3. Other categories may be added to the Kenny Self-Care Evaluation.
4. Each present category of the Kenny Self-Care Evaluation will be analyzed for its relevancy to patient assessment.
5. A baseline data collection phase has been added to the originally proposed initial instrument design, field-testing and validation, and training package construction phases.

FINDINGS TO DATE: Self-Care Evaluation scores on 200-300 residents of long-term care facilities have been collected in compliance with the baseline data collection phase of the project. A "rehabilitation technician" has been trained. Investigators are adhering to human studies protection procedures. The staffs of the selected facilities have been most cooperative and are acutely aware of the need for such an instrument. Their input will be included in the project where possible.

APPLICABILITY: Appropriate placement of disabled persons in adequate care facilities will be facilitated. By providing a short, easy to administer measure of physical functioning, guidelines can be developed to assess appropriate placement for handicapped individuals.

University of Washington (RT-3)
Medical Rehabilitation Research and Training Center

CORE AREAS

Bioengineering

Biophysics: Research in biophysics has studied the bioeffects of nonionizing radiation (electromagnetic, high frequency current, acoustic wave propogation, radiant and conductive heat) resulting in improved designs of therapeutic applicators in the various modalities for safer and more effective use. The basic rationale for the use of specific methods to heat specific human structures has also been described. National and international standards for safety and efficacy have been and continue to be developed and tested.

Biomechanics: Detailed theoretical and actual study of lower extremity biomechanics. The quantification of force interactions between limbs and orthoses has resulted in the more precise fitting of orthotic design to patient need. Analyses of commercially-available and experimental orthoses continue to be made.

Engineering Applied to Clinical Problems: The development and evaluation of adaptive aids through human factors engineering to contribute to improved clinical service.

Behavioral Sciences

Research predominantly centered around the introduction of learning-based behavior modification strategies to traditional rehabilitation by increasing self care skills in the physically disabled and decreasing the impact of chronic pain. Work is focused on those items which might be predictors for success or failure in a contingency management program. Biofeedback represents another, more specialized and technological application of learning-based strategies under examination. Additionally, different treatment methods in speech and communication problems are being tested for their effectiveness.

Neurophysiology

Studies concerned with elevating the state-of-the-art in neuromuscular electrodiagnosis and in discovering animal models for various human crippling disorders.

Muscle Physiology

Research involved in maximizing positive functions of normal and diseased muscle and minimizing secondary disabilities resulting from damaged or impaired muscle with the hope of someday preventing the development and treating contracture on a more precise basis.

Health Care Delivery

A series of projects related to the improvement of efficiency and quality of health care, whether through the expansion of training to meet demand or the study of the cost-benefits of rehabilitation outcomes of certain categorical diseases. Means of enhancing system accountability are also studied. Generally these studies identify needs of a specific population, ways in which these needs can be met and where possible, evaluate the outcome of intervention. Since manpower is often a major bottleneck in meeting identified needs, studies have been undertaken to determine how its shortage may be influenced.

UNIVERSITY OF WASHINGTON

Justus F. Lehmann, M.D., Director
University of Washington Medical
Rehabilitation Research and Training Center
CC814 RJ-30
Seattle, Washington 98105

PROJECT TITLES BY FY 1977 STATUS

COMPLETED

	Abstract No.
The Effects of Ultrasound on Bone Healing (Thaworn Hongladarom, M.D.)	067
Evaluation of Advanced Designs of Microwave Diathermy Applicators (Justus F. Lehmann, M.D.)	068
Basal Ganglia Influences on Axial and Proximal Musculature (Marjorie E. Anderson, Ph.D.)	069
A Controlled Assessment of the Effect of Submaximal Exercise in Muscular Dystrophy (Barbara J. DeLateur, M.D.)	070
Rehabilitation of Partial Peripheral Nerve Injuries in the Severely Disabled (Former Title: Return of Strength in Partial Peripheral Nerve Injuries) (George H. Kraft, M.D.)	071
Assessment of the Effect of Pacing on Quadriceps Strengthening (Barbara J. DeLateur, M.D.)	072
Evaluation of Methods and Aids Used in Gait Training (Former Title: An Assessment of Training Procedures and Devices to Achieve Controlled Partial Weight-Bearing) (C. Gerald Warren, M.P.A.)	073
Mechanical and Functional Evaluation: Various Designs of Knee Ankle Orthoses Used in Paraplegia (Former Title: Mechanical Functional Evaluation of Forces on Thigh and Leg Resulting from Orthoses Application of Various Designs) (Justus F. Lehmann, M.D.)	074
An Evaluation of an Automatic Knee Locking Mechanism for a Knee Ankle Orthosis (Justus F. Lehmann, M.D.)	075
Electromyographic Activity in Chronic Tension States (Roy S. Fowler, Jr., Ph.D.)	076
Evaluation and Treatment of the Syndrome of Acute Arm Weakness: Multiple Distal Neuritis of the Shoulder Girdle (Former Title: Multiple Distal Neuritis of the Shoulder Girdle: An Electromyographic Clarification of "Paralytic Brachial Neuritis") (George H. Kraft, M.D.)	077
The Use of EMG Feedback in the Treatment of Chronic Tension States (Roy S. Fowler, Jr., Ph.D.)	078

Operant Conditioning Methods in Management of Chronic Pain (W. E. Fordyce, Ph.D.) 079

Contingency Management Systems in Medical Rehabilitation (W. E. Fordyce, Ph.D.) 080

An Evaluation of Various Seat Cushions Designed to Prevent Pressure Sores (Barbara J. DeLateur, M.D.) 081

Investigations of Validity and Clinical Use of Children's Hand Function Test (Neal Taylor, M.D.) 082

Study of Artifacts of Electrodiagnostic Testing in Severe Neurological Disabilities (Former Title: Electromyographic Changes in Muscle Secondary to Monopolar Insertion Studies) (George H. Kraft, M.D.) 083

Basal Ganglia Control of Postural Adjustment (Marjorie E. Anderson, Ph.D.) 084

Head and Eye Position Training with a Visually Monitored Task (Marjorie E. Anderson, Ph.D.) 085

Content Analysis of Registered Nurses Recordings Before and After Implementation of Problem Oriented Charting (Rosemarian Berni, M.N.) 086

Treatment of Myositis Ossificans and Calcinosis Universalis with Disodium Etidionate (Morris R. Horning, M.D.) 087

Nursing Home Continuing Education Accountability (Do Rehabilitation Techniques learned in courses help staff, help patients to return home and lessen public assistance costs?) (Rosemarian Berni, M.N.) 088

Environmental Enhancement through Adaptive Aids for the Severely Disabled (Justus F. Lehmann, M.D.) 089

A Comparison of Pneumatic and Conventional Double Upright Orthoses (Justus F. Lehmann, M.D.) 090

Nerve Conduction Measurement by the Use of Double Stimulus Technique (Eugen Halar, M.D.) 091

The Effectiveness of Instructional Units in Describing Architectural Barriers for Residence Selection (Marilyn B. Wittmeyer, O.T.R., B.A.) 092

Short Leg Bracing in Selected Cases of Crouch Gait (Morris R. Horning, M.D.) 093

A Comparison of Subjective Feelings of Pain with Impressions Obtained by Professional Personnel (Bruce M. Gans, M.D.) 094

Electromyographic Feedback in the Training of Persons Who are Hemiplegic (Martha Trotter, B.S.) 095

CONTINUING

Postoperative Care of Patients with Total Hip Joint Replacement Using Ultrasound (Justus F. Lehmann, M.D.) 096

Program on the Quantitation of the Effects of Electromagnetic Energy on Human Tissue (Arthur W. Guy, Ph.D.) 097

Severe Physical Disabilities of Unknown Etiology (Former Title: Cellular Hypersensitivity Research Project) (George H. Kraft, M.D.) 098

Severe Disabling Polyneuritis of Unknown Cause: The Development of a Research Model (Former Title: Experimental Allergic Neuritis in the Guinea Pig) (George H. Kraft, M.D.) 099

Mechanism and Treatment of Muscle Contracture in Disabling Diseases
A. Length Chances in Tendon Aponeurosis of Origin and Insertion and in Muscle Fibers in Soleus Immobilization Contracture
B. Denervation Hypertrophy (Walter C. Stolov, M.D.) 100

Quantification of the Biomechanical Function of Various Designs and Adjustments of Ankle Foot Orthoses (Former Title: Evaluation of Ankle-Foot Orthosis Applications to Hemiplegic Patients) (Justus F. Lehmann, M.D.) 101

The Semantic Analysis of Clinical Pain (W. E. Fordyce, Ph.D. 102

Motor Point Blocks Phase III (Barbara J. DeLateur, M.D.) 103

Temperature Measurement in the Human Thigh during the Application of Hot or Cold Packs, Followed by Ultrasound (Justus F. Lehmann, M.D.) 104

Gastrocnemius Muscle and Tendon Length in Normal and Stroke Patients (Eugen M. Halar, M.D.) 105

Footwear and Posture: Phases I-V (Barbara DeLateur, M.D.) 106

A Controlled Study of the Use of Temperature Feedback for the Treatment of Raynaud's Disease (Roy S. Fowler, Jr., Ph.D.) 107

The Effectiveness of EMG Muscle Relaxation Training as a Function of Feedback Mode and the Muscle Trained (Roy S. Fowler, Ph.D.) 108

An Automated Nerve Conduction Velocity Device (George H. Kraft, M.D.) 109

Evaluation of Wheelchair Designs for Quadriplegic and Paraplegic Patients (Justus F. Lehmann, M.D.) 110

Control of Spasticity with EMG Biofeedback in the Incomplete Spinal Cord Injured Patient (Jeffrey Steger, Ph.D.) 111

Rehabilitation Indicators: A Method for Enhancing Accountability (This project, RSA funded, appears nominally within RT-1. Work on the project is centered in RT-1, RT-3, VA Hospital, Brecksville, Ohio, and University of Georgia.) (Wilbert E. Fordyce, Ph.D.) 112

NEW

Effective Training in Rehabilitation Medicine in New Medical School Curricula (Frederick Kottke, M.D.) 113

Incorporation of a Lexan "Check Socket" into a Definitive Patellar Tendon Bearing Prosthesis (C. G. Warren, M.P.A.) 114

Functional Distinction Between Neural Systems Involved in the Disabilities of Parkinson's Disease (Marjorie L. Anderson, Ph.D.) 115

Modification of Speech Patterns of Normal and Dysarthric Speakers as a Function of Four Rate Control Strategies (David R. Beukelman, Ph.D.) 116

Rehabilitation Needs of Cancer Patients (Justus F. Lehmann, M.D.) 117

Respiratory Function of Quadriplegic Individuals: Influenced by Glossopharyngeal Breathing Training and Periodic Long Term Follow-Up (Rosemarion Berni, R.N., M.N. and David R. Beukelman, Ph.D.) 118

Measurement of Musculature Blood Flow Induced by Microwave Diathermy (Justus F. Lehmann, M.D.) 119

Mapping of Microwave Fields Surrounding Human Subjects Under Diathermy Treatment (Justus F. Lehmann, M.D.) 120

DISCONTINUED 1976

Shaping Self-Care Behaviors in Patients with Chronic Disabilities (Patricia Sand, Ph.D.)

Automated Analysis of EMG Signals for the Diagnosis of Neuro Muscular Diseases (Justus F. Lehmann, M.D.)

Motor Point Blocks Utilizing Electromyographic Verification of Injection Sites, Phase II (Barbara J. DeLateur, M.D.)

DISCONTINUED 1977

A Device to Monitor a Patient's "Up Time" by Clinical Nurses Caring for Patients on Operant Conditioning Programs (Rosemarian Berni, M.N.)

Reduction of Phobic and Avoidance Responses to Visible Body Alteration in Cancer Patients (Patricia L. Sand, Ph.D.)

Comparison of Excretion C.M.G. with Air Cystometry in Neurogenic Bladders (Clyde Nicholson, M.D.)

Pressure Monitoring Between Tissue and Rigid Dressing in Immediate Fit Post-Operative Amputees (Clyde Nicholson, M.D.)

New Designs of Knee Ankle Orthoses Using Plastic Materials (Justus F. Lehmann, M.D.)

Retraining of the Paralyzed Arm of a Stroke Patient (George Kraft, M.D.)

Experimental Study of Disabling Arthritis (Former Title: Experimental Allergic Synovitis) (George H. Kraft, M.D.)

Specific Muscle Group Training Versus Generalized Relaxation and Reciprocal Inhibition in the Treatment of Spasmodic Torticollis with Bio-feedback (Connie L. Peck, Ph.D.)

EMG and EEG Biofeedback Treatment for Sleep-Onset
Insomnia in Disability and Non-Disability Subjects (Connie L. Peck, Ph.D.)

New Designs of Ankle Orthoses Using Plastic Materials
(Justus F. Lehmann, M.D.)

DEFERRED 1976

Use of Plastic Laminates in the Fabrication of Knee-Ankle
Orthoses (Justus F. Lehmann, M.D.)

Head and Eye Position Training with a Visually Monitored
Task (Marjorie E. Anderson, Ph.D.)

OTHER

Measurement of Absorption of Experimental Hematomas as
They are Influenced by Ultrasound, Shortwave and Microwave
(Held for lack of funds) (Justus F. Lehmann, M.D.)

Testing an Automated System for Wheelchair Pushups
(W. E. Fordyce, Ph.D.)

PROPOSED

Quadriceps Pacing Phase III: Effect Dynamic Exercise on
Strength (Barbara J. DeLateur, M.D.)

The Incidence of Paraspinal Musculature EMG Abnormalities
in Cancer Patients with Known Spinal Metastasis (Joel A. DeLisa, M.D.)

The Development of an MMPI Codebook for Use in Medical Rehabilitation
Settings (Joann Brockway, Ph.D.)

Periodic Evaluation of the Respiratory Function of Discharged
Quadriplegic Patients (Rosemarian Berni, R.N., M.N.)

Evaluation of a Circularly Polarized Microwave Diathermy
Applicator (Justus F. Lehmann, M.D.)

Function Distinction between Neural Systems Involved in the
Disabilities of Parkinson's Disease (Marjorie E. Anderson, Ph.D.)

Tests of the Model for Motor Control Deficits in Parkinson's Disease
and Other Involuntary Movement Disorders (Marjorie E. Anderson, Ph.D.)

Eye-Head Movement Patterns in Individuals with Reading
Disabilities (Janet Petri, B.A.)

A Comparison of Task Completion Accuracy of Aphasic Patients
in Response to Gestural and/or Verbal Directions (David R. Beukelman, Ph.D.)

Influence of Lesion Level, Time of Onset, and Glossopharyngeal
Breathing Treatment on Vital Capacity Measurements of Quadriplegic
Patients (David R. Beukelman, Ph.D.)

Modification of Speech Intelligibility and Speech Duration
Segments of Normal and Dysarthric Speakers as a Function of Four Rate
Reduction Strategies (David R. Beukelman, Ph.D.)

Bladder-Sphincter Dyssynergia: Its Responses to Medication, Physical
Measures and Surgery as Measured by Urodynamic Procedures
(Edward J. O'Shaughnessy, M.D.)

Anal Sphincter Relaxation as a Means of Monitoring Continence and
Effective Bladder Emptying in the Spinal Cord Injured (William H. Donovan, M.D.)

Bacteriologic Monitoring of a Bladder Training Program Using
Intermittent Catheterization (William H. Donovan, M.D.)

067 The Effects of Ultrasound on Bone Healing

Principal Investigator:	Thawom Hongladarom, M.D.	
FY 1976		
Status:	Completed	
Dates:	January, 1971-December, 1974	
Cost:	Annual $34,688 RT Annual $28,593	Projected Total $71,626 RT % of Annual Total 78%
Annual Report Reference:	#14, Page 29, R-1	

OBJECTIVE: To determine whether or not ultrasound actually can increase the rate of bone healing in experimental lesions and to define optimal conditions for such an effect.

METHODOLOGY:

1. A uniform experimental fracture of the rat's tail vertebrae was created by the designed fracture apparatus.
2. Forty-eight full grown Sprague Daley rats were used in the experiment.
3. Group I consisted of 12 rats treated with 0.2 w/cm² 30 minutes 5 days a week. Twelve rats were controls.
4. Group II consisted of 12 rats treated with 2.0 w/cm² for 30 minutes 5 days a week. Twelve rats were controls.
5. At the end of three weeks of treatment, the rats were sacrificed and the strength of fracture healing was determined by measuring the torque required to rupture.

PROGRESS AND FINDINGS:

1. During the past year, the methodology was perfected. A fracture apparatus was successfully designed to reduce the soft tissue trauma while producing a uniform fracture. An improved animal holder prevented dislocation of fragments due to handling the tail and enabled a uniform fracture to be produced and fragments to remain aligned throughout the treatment period.
2. An apparatus was designed to enable the use of a radiation pressure aparatus (Berem balance) to measure the intensity at the point of application.
3. The protocol was changed since data from the earlier study suggested that creation of two fractures on the same tail might introduce other variables such as interference with blood flow. Furthermore, there was little variability in the strength of the ninth vertebrae of the same crop of rats.
4. Analysis of the data showed no difference between a dosage level which produced no rise in temperature (0.08 w/cm²) and one which caused an 8° rise (0.80 w/cm²).

APPLICABILITY: A large number of fractures showed delayed healing. At the same time, any methods which would accelerate bone healing would also decrease the period of incapacitation in persons suffering from a fracture. This would have significant influence on the rehabilitation of the patient and type of work he could eventually perform.

068 Evaluation of Advanced Designs of Diathermy Applicators

Principal Investigator:	Justus F. Lehmann, M.D.	
1976		
Status:	Continuing	
Dates:	January, 1969-December, 1975	
Cost:	Annual $17,825 RT Annual $13,570	Projected Total $60,113 RT % of Annual Total 72%
Annual Report Reference:	#14, Page 53, R-6	
FY 1977		
Status:	**Completed**	
Dates:	**January, 1969-February, 1976**	
Cost:	**Annual $21,890** **RT Annual $17,290**	**Projected Total $62,100** **RT % of Annual Total 79%**
Annual Report Reference:	**#15, Page 60, R-6**	

OBJECTIVE: To develop a diathermy machine which will be accepted as a selective muscle healing device and also be compatible with federal safety regulations set forth by the Bureau of Radiological Health.

METHODOLOGY: Complete federal regulations have not been set, therefore, complete design criteria cannot be completed until then. Once they have been set down, the design can be completed within these constraints to provide an optimal tissue heating. It will be at this point that the clinical evaluation will be resumed to make discrete measurements of the temperatures produced within the tissues.

FINDINGS TO DATE: Temperatures were recorded in thighs of human volunteers before, during and after diathermy application with an air cooled contact diathermy applicator operating at 915 MHz. Temperature distributions were plotted, and from the rates of temperature increase or decrease due to blood flow, peak power levels and blood flow values were calculated. At 1-2 cm. in the muscle the maximum absorbed musculature averaged 27.23 ml per 100g. min. This blood flow value comes very close to the level of maximal blood flow — 33 ml. per 100g. min. as measured after exercise. With this applicator, good depths of penetration are produced, with the highest temperatures occurring 1 to 2 cm. in the muscle. At the end of a twenty-minute diathermy application, uniform heating is produced to a depth of 4 cm. The applicator developed has been proposed for evaluation in a separate project.

APPLICABILITY: This is essentially a new type of therapy designed to treat the most severely disabling sequelae of diseases leading to joint contractures. It is also anticipated that this may be the significance in the treatment of such serious disease entities as polymyositis. This treatment procedure is one that would be put into practice throughout hospitals of the United States.

069 Basal Ganglia Influences on Axial and Proximal Musculature

Principal Investigator:	Marjorie E. Anderson, Ph.D.	
FY 1976		
Status:	Continuing	
Dates:	January, 1971-January, 1976	
Cost:	Annual $15,609 RT Annual $10,310	Projected Total $74,700 RT % of Annual Total 66%
Annual Report Reference:	#14, Page 143, R-14	
FY 1977		
Status:	**Completed**	
Dates:	**January, 1971-January, 1976**	
Cost:	**Annual $5,382** **RT Annual $5,382**	**Projected Total $21,441** **RT % of Annual Total 100%**
Annual Report Reference:	**#15, Page 172, R-14**	

OBJECTIVES: As part of a long-range study of the neural control of posture, this study is designed to physiologically identify the pathways by which output from the basal ganglia reaches motoneurons innervating skeletal musculature. Some characteristics of synaptic transmission at each point can be determined, and such information should help to determine possible points of integration with information from various sensory systems. In addition, the specific segmental inputs to axial motoneurons must be determined, to understand the spinal mechanisms upon which basal ganglia control is exerted.

METHODOLOGY: Two separate types of experiments have been performed in the last year.

a. One monkey was prepared for chronic stimulation and recording by implanting, under sterile surgical conditions, a platform through which stimulating electrodes could be inserted into the globus pallidus and a silastic-filled chamber through which recording electrodes could be inserted into the pre-central cerebral cortex. In addition, a stimulating electrode was placed in the pyramidal tract to allow antidromic identification of pyramidal tract neurons studies in the cortex. Data are recorded on tape for subsequent analysis of stimulus-evoked changes in cortical neuron firing.

b. In acute experiments on anesthetized cats, nerves innervating neck muscles (splenus, biventer cervicis, complexus and sternomastoid) were dissected and the upper cervical segments of the spinal cord were exposed by laminectomy to allow intracellular recording from mononeurons innervating specific muscles.

Data are filmed and projected for analysis of postsynaptic potential and action potential characteristics.

FINDINGS TO DATE:

1. Biventer cervis and complexus are close synergists, with marked Ia excitatory connections from spindles of one muscle to motoneurons of the other. The splenius motoneurons studies, on the other hand, had only occasional monosynaptic connections with biventer and complexus, and although splenius is another dorsal neck extensor, it seems relatively independent from these muscles at the spinal level. This is consistent with the somewhat different effects evoked in splenius vs. complexus and biventer motoneurons from vestibular and tectal areas of the brainstem.
2. Splenius, complexus and biventer all received predominantly excitatory inputs from the cutaneous nerve tested, although they are antigravity extensor muscles and might be expected to be excited by flexor reflex afferents in cutaneous nerves.
3. The duration of afterhyperpolarization, one parameter that helps to distinguish limb motoneurons of fast vs. slow twitch motor units, varied from 50 to 105 msec., with mean durations of 69, 67 and 82 msec. for splenius, biventer and complexus motoneurons, respectively.
4. We do not find particularly profound reflex connections from contralateral muscle nerves, in contrast to the hypothesis that the bilateral coordination needed for head movement might require especially strong crossed effects.

APPLICABILITY: The results of this study will be useful to clinical personnel concerned with the management of patients with basal ganglia dysfunctions such as Parkinson's disease and some types of cerebral palsy. The information should provide a basis for the rational development of supplemental methods of muscle control, particularly of proximal musculature if the reticulospinal system plays a prominent role.

070 A Controlled Assessment of the Effect of Submaximal Exercise in Muscular Dystrophy

Principal Investigator:	Barbara J. DeLateur, M.D.	
FY 1976		
Status:	Continuing	
Dates:	June, 1971-December, 1975	
Cost:	Annual $8,410 RT Annual $5,299	Projected Total $30,192 RT % of Annual Total 63%
Annual Report Reference:	#14, Page 205, R 36	
FY 1977		
Status:	**Completed**	
Dates:	**June, 1971-December, 1976**	
Cost:	**Annual $5,252** **RT Annual $2,141**	**Projected Total $30,192** **RT % of Annual Total 41%**
Annual Report Reference:	**#15, Page 219, R-16**	

OBJECTIVE: To determine through controlled study whether or not dystrophic muscle which retains approximately 50% of its strength can be further strengthened by daily submaximal exercise.

METHODOLOGY:

1. Ten subjects with Duchene muscular dystrophy who have quadriceps with antigravity strength or better will be selected.
2. The leg to be exercised will be determined randomly.
3. Initially and at monthly intervals, the maximal torque which each quadricep can develop will be recorded.
4. Once a day, the subject will perform a series of 30 submaximal contractions of the quadriceps to be exercised. These will consist of 10 contractions at 3/4 maximum, 10 at 1/2 maximum, and 10 at 1/4 maximum. The control quadriceps will not be exercised at all.

5. The exercise program will be conducted 5 days a week for 6 months. However, the assessment of maximal torque will be conducted bilaterally for 6 additional months. Following this, maximal torque will be measured at two additional 6 month intervals for a total of 2 years in the study.

FINDINGS TO DATE: Each child did maximal contractions of both quadriceps, exercised and non-exercised, at months 0-12; three children did them at months 18 and 24, and two children at month 30. The maximal torques were averaged for each child for each quadriceps and month, and paired tests were done to determine whether the exercised side was significantly stronger than the non-exercised side. At the completion of 5 months of exercise, the exercised side was significantly stronger than the nonexercised side ($p<0.05$), and at the end of 9 months (3 months after completing the exercise program) the exercised side was again significantly stronger ($p<0.01$). In general for the other months the exercised side was stronger, but not significantly so.

APPLICABILITY: Data from this study indicate that modest increases in strength are possible, and that no harm is done by submaximal exercise, but that gains made have little or no long-term effect. Data do contradict a reported study and suggest that working conditions need not be modified to avoid exercising the dystrophic muscles of employed adults.

071 Rehabilitation of Partial Peripheral Nerve Injuries in the Severely Disabled

Principal Investigator:	George H. Kraft, M.D.	
FY 1976		
Status:	Completed	
Dates:	July, 1971-December, 1976	
Cost:	Annual $7,416	Projected Total $20,732
	RT Annual $7,416	RT % of Annual Total 100%
Annual Report Reference:	#14, Page 174, R-17	

OBJECTIVES:

1. To determine whether findings or changes in the electrical activity of muscles monitored by electromyography may serve as accurate indicators of regenerative developments in the nerves which supply them;
2. to correlate the various electrophysiologic signs and their comparison with simultaneous clinical manifestations seen in nerve injury.

METHODOLOGY: Extensive clinical and electrophysiologic studies were performed on 300 patients with peripheral nerve injuries. This data, obtained over a period of several years, was coded in order that correlations of the various features might be facilitated. Determination included tests for sensation, amplitude of muscle response, degree of muscle recruitment, and presence of abnormal potentials. Also noted were factors such as time elapsed since injury and distance between the nerve damage and the muscle under examination.

PROGRESS AND FINDINGS: Our data indicate that re-innervation is rare in the period less than two years following nerve injury. Re-innervation occurred in only 17% of completely denervated muscles during that time period. Amplitudes of voluntary potentials in partially denervated muscles increase over time with the largest amplitudes occurring in the most severely denervated muscles. Amplitudes may reach as high as 10,000 microvolts in extensively denervated muscles by eight months following injury. This indicates a severe muscle geometry secondary to profound partial denervation. This information was also correlated with more mildly injured peripheral nerves. In moderately denervated muscles amplitudes reached only as high as 6500 microvolts, and in minimally denervated muscles reached as high as 5000 microvolts during the first six months following injury. Thus, there appears to be less geographic rearrangement of motor units in mildly denervated muscles than in more severely denervated muscles.

APPLICABILITY: Peripheral nerve injury is a complex problem which unfortunately affects many adults in the vocationally productive years. A more thorough understanding of the relationship of certain electrophysiologic and clinical signs to future events in individual nerve regeneration would have considerable relevance.

072 Assessment of the Effect of Pacing on Quadriceps Strengthening

Principal Investigator:	Barbara J. DeLateur, M.D.	
FY 1976		
Status:	Continuing	
Dates:	January, 1971-August, 1975	
Cost:	Annual $9,310 RT Annual $8,120	Projected Total $22,444 RT % of Annual Total 87%
Annual Report Reference:	#14, Page 208, R-20	
FY 1977		
Status:	**Completed**	
Dates:	**January, 1971-December, 1975**	
Cost:	**Annual $3,076** **RT Annual $1,581**	**Projected Total $22.444** **RT % of Annual Total 51%**
Annual Report Reference:	**#15, Page 223, R-20**	

OBJECTIVE: To determine through appropriate pacing, in a transfer-of-training study, whether external mechanical work or fatigue of the muscle provides the better stimulus to muscle strengthening and the development of endurance.

METHODOLOGY:

1. Healthy young adult males were selected for the study. The side to be fatigued is randomly selected. Fresh subjects were used in each phase.
2. The leg to be fatigued, using the quadriceps muscle, performs a prescribed exercise to a metronome and repeats this exercise to a point of fatigue with a 50 lb. weight attached to each foot.
3. The other leg, the paced leg, performs the same number of repetitions but with a full seven-second cycle of rest between repetitions.
4. At the end of 6 weeks of training sessions, subjects shift the conditions of one leg to the conditions of the other leg. This provides a double shift transfer using paired values. Thus, if the "fatigue" leg performs better when quadriceps are performing under identical conditions in the test period, it indicates that fatigue, not merely the amount of external work, is the most important stress in developing muscle strength. If the paced quadriceps perform better, it indicates that the amount of external work is the important stimulus and fatigue is detrimental.

FINDINGS TO DATE: The findings indicate that fatigue is a far more important stimulus to the improvement of muscular performance than is the amount or duration of mechanical work. Therefore, by exercising to the point of fatigue with weights, exercise programs can be shortened with substantial savings. In addition, pilot work has been done in a third phase which compares the rate of increase in maximal isometric force from dynamic exercise programs (which are the type of exercise most often done in the clinical setting) with the rate of increase in strength from isometric programs. Phase III pilot work has also been done in the attempt to determine whether there is a lower limit, in terms of percent maximal, at which electrical-mechanical dissociation (the electromyographic correlate of fatigue) can be achieved. This is necessary preliminary theoretical research in order to determine the limits of interchangeability of relatively "low" and "high" weights in therapeutic exercise.

APPLICABILITY: If fatigue is more efficacious than mechanical work in developing muscle strength and endurance, then brief, high intensity, fatiguing exercise can be substituted for the traditionally longer or more costly mechanical exercise programs providing there are no contraindications for the patient.

073 Evaluation of Methods and Aids Used in Gait Training. (Former Title: An Assessment of Training Procedures and Devices to Achieve Controlled Partial Weight-Bearing.)

Principal Investigator:	C. Gerald Warren, M.P.A.	
FY 1976		
Status:	Continuing	
Dates:	January, 1975-January, 1977	
Cost:	Annual $14,930	Projected Total $67,682
	RT Annual $13,366	RT % of Annual Total 78%
Annual Report Reference:	#14, Page 66, R-25	

FY 1977		
Status:	**Completed**	
Dates:	**January, 1975-January, 1977**	
Cost:	**Annual $20,941**	**Projected Total $71,066**
	RT Annual $17,695	**RT % of Annual Total 84%**
Annual Report Reference:	**#15, Page 72, R-25**	

OBJECTIVES: The objectives of the study are to determine if the proposed methods of controlling weight bearing will reliably limit weight bearing when auditory feedback is provided.

METHODOLOGY:

1. A pair of force plates mounted in a walkway will be used to measure the loads imparted to them by the weight bearing limb.
2. Subjects trained by the various methods will be walked over the force plates during training to assess rates of learning and the carryover after training.
3. The training methods will also incorporate the use of feedback mechanisms to monitor the upper limits of the maximum load applied to the extremity.
4. The effectiveness of these devices in training and their carryover will be assessed.
5. The effectiveness of various canes and crutches will be evaluated by measuring the distribution of load between the cane and the weight bearing extremity during the stance phase. This will be done by simultaneously loading the pair of force plates with the cane and extremity.

FINDINGS TO DATE: Knowledge of past performance rather than response to a stimulus during ambulation is the mechanism in this method of feedback training. In evaluating the device delay in combination with auditory response time the average total delay was found to be 260 milliseconds. Due to the relatively high rates of limb-loading delays in the device and in human response it was impossible for subjects to respond directly to the load-generated stimulus. Methods of providing a stimulus which anticipates the desired load by 30% were evaluated, however this was insufficient to overcome the delay and response times. The question then remained whether or not an individual could learn through prolonged practice to accurately load a limb, and we attempted to determine whether a learning curve could be demonstrated. Evaluation of the 100 steps without feedback after the training sessions indicated that there was little immediate carry-over from the training session.

The conclusions of the study are that the use of auditory feedback in controlling partial weight-bearing on an extremity does not allow even normal subjects to perform it accurately enough to consider it as a "safe procedure" when partial weight bearing must be assured.

APPLICABILITY: The data from this study indicate that current training procedures and devices used to assist patients in graded weight bearing do not produce reliable results. Management of the patient with non-union fractures should not include a vigorous program of graded weight bearing; the desired level of partial weight bearing must be precise.

074 Mechanical and Functional Evaluation: Various Designs of Knee Ankle Orthoses Used in Paraplegia. (Former Title: Mechanical Functional Evaluation of Forces on Thigh and Leg Resulting from Orthoses Application of Various Designs)

Principal Investigator:	Justus F. Lehmann, M.D.	
FY 1976		
Status:	Continuing	
Dates:	January, 1971-January, 1976	
Cost:	Annual $44,743 RT Annual $38,303	Projected Total $129,966 RT % of Annual Total 85%
Annual Report Reference:	#14, Page 71, R-30	
FY 1977		
Status:	**Completed**	
Dates:	**January, 1971-January, 1976**	
Cost:	**Annual $45,368** **RT Annual $38,334**	**Projected Total $129,966** **RT % of Annual Total 84%**
Annual Report Reference:	**#15, Page 77, R-30**	

OBJECTIVES: The objective of this study is to measure the distribution of loads in various brace designs and to determine if damaging shear loads exist in order to optimize placement of stabilizing forces on the extremity.

METHODOLOGY: Strain gauge transducers have been incorporated in the uprights of standard double upright orthosis of seven different designs. These transducers allow the measurement of forces on the straps, and shear forces in the upright of the orthosis so that the total distribution of the force on the extremity can be measured throughout the gait cycle. Combining these measurements of shear in the uprights with the shear forces measured in a force platform, the anatomical knee shear during stance phase can be calculated as well as the total stabilizing force and the forces on each individual straps. The 32 channels of data that are generated from this experiment are processed by the department computer. Each of the six orthotic configurations is evaluated on a single patient with a minimum sample of six complete gait cycles measured for each design.

Apparatus for stress and strain analysis of orthoses has been developed. This apparatus allowed us to apply loads within the ranges that are measured during ambulation to the orthosis and systematically eliminate structural elements of the orthosis to determine precisely which of these elements are necessary to maintain the structural integrity of the orthosis. This was correlated with the elements of the orthosis that are required to provide the optimal stability and in this way the optimal functional and structural design of an orthosis may be established.

FINDINGS TO DATE: Based on measurements made on the six orthotic designs, several general principles were identified which represent a guide to the optimal design of orthoses: the forces required to stabilize the knee should be kept to a minimum by 1) applying the stabilizing force as close as possible to the knee center, and 2) by maintaining the anatomical knee as straight as possible. The stabilizing forces should be distributed so as to apply them over tolerant areas at locations which do not cause excessive shear on the limb. It was found that applying the major portion of the knee-stabilizing force below the knee markedly reduced the shear on the anatomical structures.

Further evaluation of the Craig-Scott design showed that it produces relatively low anatomical knee shear; however, application of single restraining forces below the knee concentrates this force on a relatively small bony area. In functional ambulation, the orthosis was found equivalent to other double upright designs; the rigidity of the upper thigh band and closure below the knee provide adequate stability in the orthosis. The limited number of closures signify advantage in reduced donning time; however, this relative ease is somewhat offset by the lack of posterior closures below the knee which allows the orthosis to slide on the patient's leg during transfer activities. Motion can be eliminated by adding a soft closure below the knee, which would concomittently increase donning time slightly.

APPLICABILITY: The result of this study indicates the specific designs of foot-ankle orthosis which most effectively distribute the loads over the extremity and produce the least amount of shear in the anatomical knee.

The basic biomechanics of such orthoses will provide the basis for design and development of orthoses which will have greater ultimate utility to the some 150,000 to 200,000 paraplegics who are potential ambulators.

075 An Evaluation of an Automatic Knee Locking Mechanism for a Knee Ankle Orthosis

Principal Investigator:	Justus F. Lehmann, M.D.	
FY 1976		
Status:	Continuing	
Dates:	January, 1970-December, 1975	
Cost:	Annual $22,980 RT Annual $17,425	Projected Total $59,591 RT % of Annual Total 73%
Annual Report Reference:	#14, Page 32, R-35	
FY 1977		
Status:	**Completed**	
Dates:	**January, 1970-December, 1975**	
Cost:	**Annual $22,136** **RT Annual $17,271**	**Projected Total $59,591** **RT % of Annual Total 78%**
Annual Report Reference:	**#15, Page 88, R-35**	

OBJECTIVE: To test a solenoid activated locking and unlocking knee lock to determine if it is worthwhile to involve engineering groups in a continued study concerned with designing a completely self-contained device.

METHODOLOGY: Patients' braces have been fitted with the automated locking and unlocking knee lock. These patients are then required to alternately walk with braces locked and with braces locking-and-unlocking at a comfortable rate for at least 3 minutes or as far as they can go. As they are walking O_2 consumption and heart rate are monitored. They also walked in front of a strobe light to determine center of gravity.

FINDINGS TO DATE: It has been shown that the locking and unlocking knee does work on normals and patients. If the person ambulates at normal walking speeds, there is a marked decrease in O_2 consumption when the knee joint is unlocked during the swing phase. The patients who were tested did not ambulate at a high enough speed to show this difference.

APPLICABILITY: The use of a solenoid activated knee lock may decrease the metabolic demand required while walking with the knee ankle orthosis in some individuals, thus allowing them to become more functional ambulators. Functional ambulation is an important factor in the significant portion of a patient's total rehabilitation potential.

076 Electromyographic Activity in Chronic Tension States

Principal Investigator:	Roy S. Fowler, Jr., Ph.D.	
FY 1976		
Status:	Completed	
Dates:	September, 1971-December, 1974	
Cost:	Annual $8,220 RT Annual $8,220	Projected Total $20,234 RT % of Annual Total 100%
Annual Report Reference:	#14, Page 178, R-41	

OBJECTIVES:

1. To compare EMG activity patterns of normals and patients with chronic tension pain;
2. to measure the ability of both groups to estimate tension levels.

METHODOLOGY:

1. Subjects will sit in a comfortable chair for one hour and surface electrodes will be applied over the trapezius muscles.
2. Subjects will be asked to fill out an MMPI and give an estimate of muscle tension levels every 5 minutes using a ten point scale.
3. The total electromyographic output for all subjects will be compared in order to assess whether chronic tension patients emit a significantly greater total EMG output.

4. Correlations will be calculated between subjective estimates of tension level and measured EMG output.

PROGRESS AND FINDINGS:

1. One hundred thirty seven subjects have been tested. This includes 90 paid normal volunteers and 48 patients with a diagnosis of chronic muscle tension and related pain.
2. The data suggests that those normals and subjects with chronic muscle tension pain are unable to accurately assess their tension states as measured by EMG output. The correlations between a subject's estimate of tension and the actual measured EMG output are in the random range for both normals and clinical subjects.
3. However, clinical subjects as a group produce approximately 50% more muscle activity than normals in a standardized task. They are in fact more tense than normals.
4. Therefore, an effective treatment procedure not only must train pain patients to relax the musculature but must also train them to accurately recognize their states of tension. This may enable the pain patient to stop high and continued levels of tension before pain and fatigue become a problem.
5. Also indicated is that biofeedback procedures aimed directly at teaching relaxation will be only partially effective if the patient is not able to recognize the early warning signs of tension.

APPLICABILITY: This study will provide information allowing the development of more effective disability reducing treatment procedures. The biofeedback approach directly affects muscle tension levels and should significantly reduce the need for potentially dangerous drugs and/or destructive surgery procedure.

077 Evaluation and Treatment of the Syndrome of Acute Arm Weakness: Multiple Distal Neuritis of the Shoulder Girdle. (Former Title: Multiple Distal Neuritis of the Shoulder Girdle: An Electromyographic Clarification of "Paralytic Brachial Neuritis")

Principal Investigator: George H. Kraft, M.D.

FY 1976

Status: Continuing

Dates: January, 1971-December, 1976

Cost: Annual $3,279 Projected Total $7,902

RT Annual $3,279 RT % of Annual Total 100%

Annual Report Reference: #14, Page 183, R-43

FY 1977

Status: **Completed**

Dates: **January, 1971-December, 1976**

Cost: **Annual $3,279** **Projected Total $7,902**

RT Annual $3,279 **RT % of Annual Total 100%**

Annual Report Reference: **#15, Page 205, R-43**

OBJECTIVES: To investigate data revealed by use of electrodiagnostic equipment in the evaluation of Paralytic Brachial Neuritis. Patterns which emerge from these tests may add to the body of useful knowledge of this disorder. It is hoped, further, that a technique, hitherto lacking, for the certain confirmation of suspected cases, may be standardized and accepted.

METHODOLOGY: Electrodiagnostic studies were performed on patients with acute shoulder pain followed by muscle weakness in the upper extremities and also on normal volunteers. These tests, nerve conduction velocity determination and electromyography, are indicators of nerve and muscle function and were performed on several occasions in affected shoulder areas. Normal values for nerve conduction latency, time between stimulation of nerve and ensuing muscle response, have been established and compared with values recorded from individuals with paralytic brachial neuritis.

FINDINGS TO DATE: Shoulder girdle neuritis occurs with typical heralding symptoms of acute sharp shoulder pain followed in 3 to 5 days with a dull ache about the shoulder. The most commonly affected nerves appear to be the axillary nerves and the suprascapular nerves. In almost all cases this year as in previous years, these nerves appear to be affected.

APPLICABILITY: Patients with this disorder may experience shoulder muscle paralysis of considerable duration, and in some cases, the disability is permanent. The development of paralytic brachial neuritis thus often necessitates vocational and other significant adjustments. Unfortunately, at the present, the magnitude of these adjustments is impossible to predict for the individual patient, since sound prognostic indicators do not exist. Of major relevance, therefore, is the working out of diagnostic and prognostic tests: for those patients whose prognosis is less optimistic regarding return of shoulder function, vocational rehabilitation may be realistically introduced at once.

078 The Use of EMG Feedback in the Treatment of Chronic Tension States

Principal Investigator:	Roy S. Fowler, Jr., Ph.D.	
FY 1976		
Status:	Completed	
Dates:	January, 1970-December, 1974	
Cost:	Annual $7,427	Projected Total $23,009
	RT Annual $5,171	RT % of Annual Total 69%
Annual Report Reference:	#14, Page 186, R-44	

OBJECTIVE: To test the effectiveness of EMG feedback in the treatment of pain resulting from chronic tension states.

METHODOLOGY: Newly developed EMG equipment provides analog feedback systems using sound, color, and visual display. Subjects are taught to relax and to recognize tension levels using the feedback displays. A portable EMG feedback system has been developed to use while subjects are engaged in routine daily activities. The treatment procedure will be evaluated using patient-kept diary records gathered before, during, and following treatment. Their records will include statements of the proportion of each day spent in upright, reclining, or lying positions, hourly scale ratings of pain severity, and medicine intake.

PROGRESS AND FINDINGS: One hundred six patients with chronic muscle related pain (tension headache, neck and shoulder pain, back pain, torticollis, facial tic, chronic jaw pain, and stiff men's syndrome) have been treated or are in treatment. Analysis of completed records on approximately 50 patients yields a judged success rate of 57%. This judgment is based on the evaluation by independent raters of pain ratings, medication intake records and diary records.

APPLICABILITY: It is hoped that by training the subject in the recognition and reduction of tension, pain will be eliminated or significantly reduced without destructive or dangerous side effects. Debility due to chronic tension states should be significantly reduced.

079 Operant Conditioning Methods in Management of Chronic Pa[illegible]

Principal Investigator:	W. E. Fordyce, Ph.D.	
FY 1976		
Status:	Continuing	
Dates:	January, 1968-December, 1977	
Cost:	Annual $19,168	Projected Total $75,200
	RT Annul $9,853	RT % of Annual Total 51%
Annual Report Reference:	#14, Page 104, R-61	

FY 1977

Status: **Completed**

Dates: **January, 1968-December, 1977**

Cost: **Annual $20,171** **Projected Total $75,200**
RT Annual $10,856 **RT % of Annual Total 54%**

Annual Report Reference: **#15, Page 116, R-61**

OBJECTIVES:

1. To develop treatment methods based on learning principles of reduction or elimination of disability from chronic pain;
2. to develop selection criteria for patients for the program;
3. to develop teaching material for training others how to use the methods.

METHODOLOGY:

1. Patients admitted to the program are identified as having problems of chronic clinical pain resulting in significant impairment in daily functioning and for which no alternative treatment is proposed.
2. Following evaluation and selection, but prior to admission, patients complete two weeks of diary forms recording activity levels and medication intake. They are then admitted.
3. Treatment lasts for several weeks of inpatient and outpatient care. During that period, the contingencies of rest, attention, and medication are programmed relative to the incidence of pain behavior and functional activities. Family members are trained in selective responsiveness to pain and well behavior.
4. Physical activities productive of pain are programmed to gradually increase the amount performed.
5. Records are kept on performance of physical activities, and the distribution of reclining, sitting, and standing or walking time. Records are kept on medication intake also. Medications are systematically reduced during the course of the program.

FINDINGS TO DATE: The original objectives of this project have been achieved. The use of behavioral concepts and behaviorally-based methods for the evaluation and treatment of chronic pain began with the work done in RT3. Individual case studies first appeared in 1968 and subsequently more extensive data and results were described. Building on the work of R-61, two proposals have been prepared.

APPLICABILITY: Patients previously identified as permanently disabled in chronic pain have been shown to be potentially restorable to full or substantial functioning, including employment, through the use of operant conditioning methods in treatment of pain. Results indicate that the evaluation of chronic pain should be changed to take into account learning factors.

080 Contingency Management Systems in Medical Rehabilitation

Principal Investigator: W. E. Fordyce, Ph.D.

FY 1976

Status: Continuing

Dates: January, 1969-January, 1975

Cost: Annual $18,941 Projected Total $47,750
RT Annual $13,170 RT % of Annual Total 69%

Annual Report Reference: #14, Page 114, R-63

FY 1977

Status: **Completed**

Dates: **January, 1969-December, 1977**

Cost: **Annual $19,449** **Projected Total $47,750**
RT Annual $17,431 **RT % of Annual Total 90%**

Annual Report Reference: **#15, Page 121, R-63**

OBJECTIVE: To develop and test techniques for using behavior analysis contingency management systems in medical rehabilitation settings. Behavior influenced includes medication intake, self-control food and fluid intake, weight control, smoking, pain behavior, and self-help skills such as feeding, drinking, and walking.

METHODOLOGY: Behavior analysis and contingency management systems are applied to individual patient problems. Behaviors to be changed are specified and recorded. Consequences in the environment designed to influence the rate of those behaviors are specified and programmed. Results are recorded and when appropriate, summarized across groups of patients.

FINDINGS TO DATE: The major activity in past years has been to accumulate more experience with these procedures and to test out new applications. Training materials have been assimilated into the occupational therapy and physical therapy curricula.

Specifically, demonstrations of impact of contingency management systems on patient performance have been striking. It is now evident that therapists in medical rehabilitation settings are in a position to influence markedly the effectiveness of patient participation in the rehabilitation process. There is ample reason to expect that precision application of these methods substantially influences how much patients can achieve, how long it takes, and how much it costs.

While behavioral methods did not originate in this project, but much of the work in applying these methods in medical rehabilitation settings has been performed in this Center, the task of establishing behavioral methods in operational programs and in basic curricula has been accomplished. Now that the general foundations have been laid, more specific applications of behavioral methods to chronic illness, disease and disability will be proposed.

APPLICABILITY: This project is important to rehabilitation in several ways. First, the procedures used serve to reduce disability and enhance patient performance. Often this can be done more rapidly and inexpensively using these techniques than by alternative methods. Second, application of the methods serve to teach rehabilitation professionals how to use these techniques. Third, the techniques ensure that objective evaluation of whether or not change is occurring is available.

081 An Evaluation of Various Seat Cushions Designed to Prevent Pressure Sores

Principal Investigator:	Barbara J. DeLateur, M.D.	
FY 1976		
Status:	Completed	
Dates:	June, 1971-December, 1974	
Cost:	Annual $5,100 RT Annual $3,473	Projected Total $21,875 RT % of Annual Total 68%
Annual Report Reference:	#14, Page 85, R-81	

OBJECTIVE: To assess biologically the effectiveness of representative types of seat cushions designed to prevent decubitus ulcers.

METHODOLOGY: Seven repreesentative cushions were selected. A rested subject is placed on one cushion. At the end of one-half hour the area over the ischial tuberosities is examined for redness. If red, a stop watch is started and the number of seconds required for complete fading is measured. After one half hour complete rest, the subject is placed on the next cushion. The process is repeated until all seven cushions have been assessed. On subsequent days the cushions are assessed in a new order. A 7 x 7 Totin square was designed as control for the effects of order of assessment.

PROGRESS AND FINDINGS:

1. Four replications of the Totin square have been carried out.
2. Preliminary analysis indicates no consistent superiority of one cushion over another.
3. A hardness tester" has been ordered as an alternative, non-biological validity cross check.
4. The original physical cross check was as follows: smoothly machined curved blocks of wood, with different radii of curvature were applied to the cushions with weights superimposed and with a series of four pressure transducers interposed between the wood and cushion.

APPLICABILITY: Decubital ulcers are a cause of morbidity, time loss, and hospital expense for many handicapped people. For previously rehabilitated workers they result in considerable time lost from work. These findings will aid the handicapped to determine which wheelchair cushions are of real benefit in the prevention of such ulcers.

082 Investigations of Validity and Clinical Use of Children's Hand Function Test

Principal Investigator:	Neal Taylor, M.D.	
FY 1976		
Status:	Completed	
Dates:	January, 1972-December, 1974	
Cost:	Annual $1,546 RT Annual $1,546	Projected Total $13,623 RT % of Annual Total 100%
Annual Report Reference:	#14, Page 236, R-84	

OBJECTIVES:

1. To determine whether hand function in the significant proportion of myelomeningocele children is deviant;
2. to determine whether the magnitude or incidence of hand function deviancy can be reduced through training or systematic therapy;
3. to determine whether hand function testing can be used to evaluate objectively the results of treatment.

METHODOLOGY:

1. Medical charts were reviewed for 219 myelomeningocele children between the ages of 6-19. Charts were excluded if the child did not meet the following criteria: IQ = 56; residence within the greater Seattle area; the chart contained clear information relating to spinal cord lesion and extent of hydrocephalus.
2. Following parental consent, the following tests were administered: developmental hand function test, Frostig test for visual perception, and Stanford-Binet or Wechsler intelligence scale for children. If any of the tests had been given within the past 8 months, these results were used.
3. Test means were compared and the results summarized.

PROGRESS AND FINDINGS: The most striking findings were that over 80% of the children studied showed hand function deficits. Approximately 60% of the children identified as having "normal" intellectual functioning had significant hand functioning as defined by a speed of more than two standard deviations below that found for the normative group.

APPLICABILITY: Impaired hand function may often be a major barrier to achieving pediatric rehabilitation goals of self care activity, ambulation, and education. By using a standardized hand function test for the assessment and evaluation of treatment, specific areas of deficit can be pinpointed, allowing treatment to focus on these areas. Hand function evaluating has application to many patient populations including cerebral palsy, spina bifida, arthritis, muscular dystrophy, and hemophilia.

083 Study of Artifacts of Electrodiagnostic Testing in Severe Neurological Disabilities. (Former Title: Electromyographic Changes in Muscle Secondary to Monopolar Insertion Studies)

Principal Investigator:	George Kraft, M.D.	
FY 1976		
Status:	Continuing	
Dates:	September, 1972-December, 1975	
Cost:	Annual $5,405 RT Annual $5,405	Projected Total $23,141 RT % of Annual Total 100%
Annual Report Reference:	#14, Page 190, R-91	
FY 1977		
Status:	**Completed**	
Dates:	**September, 1972-December, 1974**	
Cost:	**Annual –** **RT Annual –**	**Projected Total $23,141** **RT % of Annual Total –**
Annual Report Reference:	**#15, Page 208, R-91**	

OBJECTIVES:

1. To determine using laboratory models, whether abnormal potentials seen in serial electromyography of the same site may be partially or wholly attributable to muscle trauma resulting from repeated needling;
2. to isolate and eliminate factors which may contribute to the development of severity of damage.

METHODOLOGY: Serial electromyographic studies of varying length and frequency are performed on portions of guinea pig gastrocnemius muscle. As many as four needling sites per hind leg may be investigated in this manner. With the guinea pig immobilized and, in some instances, under anesthesia, a single intensive needling session or brief sessions at daily or other intervals are conducted, using a TECA model J electromyograph and components. Severity of myopathy is evaluated according to standards applied in the clinical setting.

FINDINGS TO DATE: This study was completed during 1975, and the results which were presented at several meetings during the year will be written up into a scientific paper. The completed study demonstrated that trauma from electromyographic needles can produce electromyographic potential changes in a large number of areas tested (70% of sites tested) but that they are not seen before 48 to 72 hours. The earliest abnormalities were seen at 48 hours, and by 72 hours all sites which were going to develop abnormalities did so. Therefore, abnormal EMG changes are not technical artifacts of that immediate study and are not due to EMG testing within 48 hours.

APPLICABILITY: The finding of abnormal electrical potentials on extensive electromyography has always perplexed clinicians. It has never, prior to this study, been determined whether the abnormalities could be the result of the study. This study helps confirm the fact that they are most likely not due to results of the study unless a) either previous electromyography had been done several days before, or b) the investigation was very intensive in one area (a very unlikely situation in clinical electrodiagnosis). It is assumed that this information will be of value to clinical electromyographers.

084 Basal Ganglia Control of Postural Adjustment

Principal Investigator:	Marjorie E. Anderson, Ph.D.	
FY 1976		
Status:	Continuing	
Dates:	February, 1973-January, 1976	
Cost:	Annual $31,083 RT Annual $10,297	Projected Total $76,585 RT % of Annual Total 33%
Annual Report Reference:	#14, Page 157, R-93	
FY 1977		
Status:	**Completed**	
Dates:	**February, 1973-January, 1976**	
Cost:	**Annual $27,750** **RT Annual $6,785**	**Projected Total $76,585** **RT % of Annual Total 24%**
Annual Report Reference:	**#15, Page 188, R-93**	

OBJECTIVES:

1. To record and identify any changes in discharge pattern of neurons in the putamen and the external and internal globus pallidus (brain areas) of monkeys trained to keep a stable upright head position when the primate chair holding them is tilted;
2. to identify, by changing the stimuli presented to the animal and/or the required motor responses, the input and output parameters to which the neuron discharge is related;
3. to test models, derived from acute experiments, of the functional interconnections between nuclei of the basal ganglia.

METHODOLOGY:

1. Monkeys **(M. mulatta)** are trained to reflect a light into a photocell by maintaining a stable upright head position for a given period of time and maintenance of correct head position for the required time causes delivery of an applesauce reward.
2. Recording microelectrodes are inserted into the basal ganglia through a chamber surgically implanted in the skull. Electromyographic activity of the body musculature is also recorded via fine implanted wires.
3. The chair is tilted in the anterior position or lateral directions with a servosystem driven with a function generator. Chair position is monitored with a potentiometer.
4. The variables are recorded on magnetic tape and analyzed by computer.
5. The tonic firing patterns of the neurons studied is determined during static horizontal or tilted positions. The data is examined for changes of firing rate correlated with the position, velocity, and acceleration of chair tilt.
6. Individual animals are trained for about one month prior to surgery and one month following surgery. Recording is done for a subsequent one to two months.

PROGRESS AND FINDINGS:

1. Over 125 neurons have been recorded to date in three animals trained in the current paradigm. Neuronal tonic firing rates during static chair positions were similar to those reported by DeLong (1971); cells in the putamen fire at irregular slow rates and cells in the globus pallidus fire at high tonic frequencies interrupted by brief pauses. Few neurons in putamen or globus pallidus show different firing rates at different static chair positions, but most globus pallidus neurons and some in putamen show changes in firing correlated with some phase of continuous or irregularly triggered single cycle sinusoidal or ramp chair tilt. In some cases, the firing rate is most strongly correlated with chair position and in others with velocity or acceleration.
2. The data indicates that firing patterns of neurons in putamen or globus pallidus do change in association with tilt-elicited postural adjustments in this operant paradigm. Presently, the sensory inputs and motor outputs with which these changes are most strongly correlated are being dissected.
3. Currently animals are being trained under stimulus control to differentially maintain fixed head positions in space versus head positions relative to the tilted chair in order to maximize neck as opposed to vestibular stimuli. Fixing patterns from these actively controlled paradigms will be compared to patterns when the head is artifially stabilized as an initial check of some active motor output to which the neuron discharge pattern may be related.

   In summary, neurons in the putamen and globus pallidus change their firing during a postural adjustment to both static and dynamic tilt, and in our paradigm, this was especially true during dynamically changing postural support. The paradigm appears to be a model in which one could study the differences in behavior of these neurons after destruction of the nigrostriatal differences in behavior of these neurons after destruction of the nigrostriatal system, for example. Such a model is the best one currently available to approximate the changes in motor control seen in Parkinson's disease.

APPLICABILITY: A better understanding of the parameters of sensory stimuli handled by the basal ganglia and of the way in which they affect movement would help create a better approach to the therapy of patients with basal ganglia disease, as well as a more rational array of techniques from which to select.

085 Head and Eye Position Training with a Visually Monitored Task

Principal Investigator:	**Marjorie E. Anderson, Ph.D.**	
FY 1977		
Status:	**Completed**	
Dates:	**October, 1973-January, 1976**	
Cost:	**Annual $538** **RT Annual $538**	**Projected Total $14,692** **RT % of Annual Total 100%**
Annual Report Reference:	**#15, Page 192, R-94**	

OBJECTIVE: To develop and test a training method which would assist cerebral palsied children to learn to control extraneous motions of the head.

METHODOLOGY:

1. Children with head control problems are selected from the cerebral palsied population seen at local clinics or schools. Each training session includes equal periods of time with each of two training paradigms: a visual monitoring system and an auditory monitoring system.
2. In the visual feedback paradigm, the child is fitted with a light weight headlamp and instructed to watch the beam and keep it on a target to score points. The target includes a photocell whose output is integrated and fed to a counter. The time required on target can be varied via the counter trigger level for shaping the subject's performance.
3. In the auditory feedback paradigm, the headlamp is turned off and a tape cassette player is activated by mercury switches on the headband set to the same "on target" position as used in the visual paradigm. Music or story tape cassettes will be chosen to suit the child's interest.
4. Normalized scores are calculated for each paradigm in a training session and visual and auditory training sequence is alternated for each successive session. Children will be trained for a minimum of 3 sessions per week. Scores for visual versus auditory paradigms will be compared for each child.

PROGRESS AND FINDINGS:

1. Approximately 500 medical records of children followed by the Children's Orthopedic Hospital cerebral palsy and orthopedic clinics were reviewed to define prospective subjects. Sixty children with head control problems were identified. Five students at the Lake Washington Special Education Center were selected to participate in a pilot study, scheduled in cooperation with physical therapists at the Center.
2. Target and monitoring equipment for research purposes was designed and constructed.
3. The pilot project allowed identification and correction of equipment and experimental design problems.
4. Each child participated in 3 training session in the pilot study. The four who were not mentally retarded all achieved increasing scores in successive sessions using visual feedback paradigm. The auditory system has not been tested since necessary equipment changes were made.
5. These preliminary data are encouraging enough to expand the study during the 1974-75 grant period. Physical and occupational therapy students will participate as will some therapists at the center.

APPLICABILITY: Adequate head control should lead to higher intellectual achievement as well as better general body motor control. This would increase the child's vocational and social capabilities, resulting in better possibilities for employment and financial and social independence.

086 Content Analysis of Registered Nurses' Recordings before and After Implementation of Problem Oriented Charting

Principal Investigator:	Rosemarian Berni, M.N.	
FY 1976		
Status:	Completed	
Dates:	October, 1973-July, 1974	
Cost:	Annual – RT Annual –	Projected Total $720 RT % of Annual Total –
Annual Report Reference:	#14, Page 244, R-99	

OBJECTIVE: To compare by a guideline type of content analysis the documentation of the initial steps of the nursing process found in registered nurse's recordings on patients with specific problems and with a specific treatment approach before and after problem oriented charting has been instituted on a particular nursing unit.

METHODOLOGY:

1. The descriptive method will be used to determine the frequency with which something occurs or with which it is associated with something else. The description will include the rehabilitation unit's milieu and the nursing staff's participation in problem oriented charting.
2. The design will include the collection and review of data from nurse's recordings documented by the whole population of registered nurses working on a medical rehabilitation ward before and after the implementation of problem oriented charting.

3. The criterion variables and their characteristic elements in the guidelines for raw data classification are developed from a prestudy sample of nursing, recordings from patient charts on the study ward, from the literature regarding the nursing process and operant conditioning, and from resource people in the field of nursing and psychology.
4. The observer reliability of the investigator's review of the recording using the guidelines were checked by a second jury of registered nurses who have used the operant conditioning approach to chronic low back pain for over three years in their nursing practice. Four charts were independently analyzed by the members of the jury and compared with the investigator's review.

FINDINGS TO DATE: **Policy, program or practice changes:** Careful audits should stimulate better continuity of nursing care of disabled and long term care patients, e.g. one nursing home demonstrated a 33-1/3% reduction in drug costs using the described method.

APPLICABILITY: Nurse recordings during the first 24 hours of hospitalization are important for the following reasons: (1) it may be the only opportunity to meet the family; (2) since the nurse is accountable for her action, it is during this time that the nurse should plan the patient's care from available data; (3) it is important to promptly record data; (4) prompt planning from good records will remove any doubts from the patient about the cohesiveness and experience of the team; and (5) it is important to record if the patient demonstrates different behavior from that which was evaluated in the outpatient clinic or at home.

087 Treatment of Myositis Ossificans and Calcinosis Universalis with Disodium Etidionate

Principal Investigator:	Morris R. Horning, M.D.	
FY 1976		
Status:	Completed	
Dates:	March, 1974-February 15, 1975	
Cost:	Annual $11,359 RT Annual $3,107	Projected Total $11,359 RT % of Annual Total 40%
Annual Report Reference:	#14, Page 168, R-106	

OBJECTIVES:

1. To decrease the frequency of appearance of new areas of ossification;
2. to increase range of motion across affected joints;
3. to further evaluate the effectiveness of the drug disodium etidronate in patients with myositis ossificans progressiva;
4. to allow surgical removal of some areas of ossification to improve the mobility and pulmonary function of the patients.

METHODOLOGY:

1. The initial population to be treated consists of 4 patients with myositis ossificans progressiva and one patient with calcinosis universalis. All these patients have been followed prior to inclusion in this study at clinics at the University Hospital and Children's Orthopedic Hospital. A total of 10 patients can be treated under this proposal.
2. There is no methodology as yet for the use of disodium etidronate on these patients.
3. Criteria for the selection of subjects are (a) radiographic evidence of extra-skeletal bone in typisol areas and digital abnormalities of the thumb or great toe; (b) ability to take oral medicine; (c) ability to return to the clinic at scheduled times, to cooperate with the investigator, and to follow any procedures at home necessary to the conduct of the study; (d) willingness to give signed informed consent as a participant in the study.

PROGRESS AND FINDINGS: None reported.

APPLICABILITY: Since mysositis ossificans progressiva is a fairly common progressive, severely disabling disease, the rehabilitation and therapy of patients is extremely important.

088 Nursing Home Continuing Education Accountability (Do Rehabilitation Techniques learned in courses help staff, help patients to return home and lessen public assistance costs?)

Principal Investigator:	**Rosemarian Berni, M.N.**	
FY 1977		
Status:	**Completed**	
Dates:	**August, 1974-August, 1975**	
Cost:	**Annual $3,312** **RT Annual $3,312**	**Projected Total $3,312** **RT % of Annual Total 100%**
Annual Report Reference:	**#15, Page 249, R-110**	

OBJECTIVES:

1. To compare the scores of written pre-tests and post-tests after a Rehabilitation Nursing Course has been presented to Nursing Home personnel.
2. To describe the extent of the application of two new concepts, namely, problem oriented charting and behavior modification.
3. To describe the degree of rehabilitative accomplishment by evaluating the enrollees behavioral check lists, including problem oriented flow sheets and records for monitoring physical and behavioral response or outcome.

METHODOLOGY: To describe the change in enrollee and patient behavior by evaluating the productivity of enrollees in a statewide nursing home rehabilitative nursing continuing education course.

The population was the total number of enrollees who completed the course, nursing assistants, L.P.N.s and R.N.s. N=720.

Evaluation instruments have been built from the objectives of the course, and the time schedule was dependent upon the course schedules. Client-patient outcomes were measured by problem oriented flow sheets monitoring behavior and physical response.

FINDINGS TO DATE: The project was completed. 570 long term care personnel from 13 geographical areas earned certificates. All trainees completing the courses improved their test scores at least by 25% and completed the curriculum's behavioral objectives. More follow-up is needed to answer the project question. 570 patients demonstrated at least one positive behavioral change as documented in the students' problem oriented records and flow sheets which were verified by the supervisors and instructors.

The course's curriculum and evaluation tools and findings were presented and approved as meeting HEW Contract #HRS 230-75-0215. This document was disseminated to state health departments as the model guidelines for the pilot group of ten states: Arkansas, Arizona, Connecticut, Florida, Kansas, Minnesota, Montana, New York, Oregon and Virginia.

APPLICABILITY: A state-wide circuit course, sponsored by a Long Term Care Association, part of the curriculum for the purpose of teaching directors of nursing and administrators a system of health care evaluation utilizing consumer outcomes was introduced.

The curriculum was adopted by HEW Region X's Regional Long Term Care Training Center.

089 Environmental Enhancement Through Adaptive Aids for the Severely Disabled

Principal Investigator:	Justus F. Lehmann, M.D.	
FY 1976		
Status:	Continuing	
Dates:	January, 1975-January, 1976	
Cost:	Annual $19,370 RT Annual $17,417	Projected Total $35,016 RT % of Annual Total 87%
Annual Report Reference:	#14, Page 92, R-112	

FY 1977
Principal Investigator: **C. Gerald Warren, M.P.A.**
Status: **Completed**
Dates: **January, 1974-December, 1976**
Cost: **Annual $21,736** **Projected Total $38,517**
RT Annual $19,588 **RT % of Annual Total 90%**
Annual Report Reference: **#15, Page 96, R-112**

OBJECTIVES: The objectives of this study will be to perform clinical evaluation of newly designed adaptive aids for the quadriplegic, to provide adequate design refinement, and modify these mechanisms for total utilization by the quadriplegic.

METHODOLOGY: Design evaluation by a team including engineers, clinicians and patients will first determine the worth of pursuing the development of prototypes. The designs will be modified to make them as safe and effective as possible prior to clinical trials. Clinical trials will be used to evaluate the utility of each device and define a set of clinical or environmental conditions. Redesign and revision will be followed by evaluation until the product is concluded to be worthy of distribution.

FINDINGS TO DATE: During this year we have produced 3 advanced prototypes of the book reader. They have been further evaluated by patients and therapists and have exceeded our expectations for reliability and versatility.

Other activities during the year have included the evaluation of a set of transfer boards. These boards allow one individual simply and quickly to transfer a spinal cord injured patient from bed to stretcher and back again. They are especially valuable in transferring a patient with an unstable spine, since the splints are placed beneath the head, shoulders, hips and knees and are interconnected by a long telescoping bar. The patient is easily slid across the sheets on the plastic surfaces of the sleds; the 3 to 4 other personnel needed to lift the patient and place him on a stretcher are no longer necessary.

Three additional adaptive aids that have been designed are:

1. A valve which will allow a quadriplegic person to empty his leg bag independently has been developed using a standard laboratory bobbet valve.
2. A mechanical amplifier which allows a quadriplegic person to operate an electric bed-control. This apparatus has been designed and published in a form which allows an occupational therapist or a patient to manufacture it.
3. A connector which allows a quadriplegic person to change his drainage system from his leg bag to his night collection system independently. It utilizes a standard laboratory connector with several simple modifications, and can be assembled by the occupational therapist or the patient himself.

APPLICABILITY: With the increased ability to care for the quadriplegic patient, his struggle for mere survival has been lessened and his vocational and social goals have been considerably expanded. This primary limitation being mechanical, he must interface with his environment through specific adaptive aids. This project would be directed toward increasing the ultimate level of independence and efficiency of the severely disabled individual. Spinal cord injured number some 6,000 people annually in the United States.

090 A Comparison of Pneumatic and Conventional Double Upright Orthoses

Principal Investigator: **Justus F. Lehmann, M.D.**
FY 1977
Status: **Completed**
Dates: **June, 1974-March, 1976**
Cost: **Annual $19,477** **Projected Total $41,531**
RT Annual $16,135 **RT % of Annual Total 82%**
Annual Report Reference: **#15, Page 99, R-113**

OBJECTIVES: This study attempted to control the parameters of ambulation in long pneumatic orthoses (with and without inserts), in standard double upright knee ankle orthoses and in short pneumatic orthoses with inserts so that the differences in results could be interpreted in biomechanical terms and their clinical significance assessed.

METHODOLOGY: Three patients, a T-12 paraplegic, a T-4 paraplegic and C-8 quadriplegic were fitted and trained with pneumatic orthoses and with standard knee ankle orthoses. After the patients were trained to full proficiency with each orthosis they ambulated alongside a motorized cart which controlled the speed of ambulation and carried all equipment for making physiological measurements. Heart rate and blood pressure were monitored before, during and after ambulation.

The change in center of gravity pathway amplitude was also measured, and this in turn was related to the change measured at the knee and ankle.

A functional evaluation of the patients wearing the different orthoses was also carried out. The patients ambulated as far as they could go at various cart speeds. The distance they traveled was measured and plotted against speed of ambulation.

FINDINGS TO DATE: It was found that the long pneumatic orthoses provide good hip and trunk stability with minimal knee buckling at speeds below 72 meters/minute. The addition of plastic ankle foot orthoses as inserts gave much better ankle stability and kept the center of gravity from dropping due to pivoting about the metatarsal head area during swing phase. This addition produced increased effectiveness of ambulation, as documented by greater distances walked and reduced oxygen consumption when the subjects ambulated in the long pneumatic orthoses.

The long pneumatic orthoses also compress the leg and abdomen, thereby tending to reduce orthostatic hypotension, which may be advantageous in the early phase of mobilization.

The short pneumatic orthoses did not have the advantages of the long pneumatic orthoses, so it would rarely be recommended. It took all patients longer to don the long pneumatic orthoses, and all felt it was very cumbersome to inflate.

The findings in this study will identify the utility and suitability of this revolutionary orthoses in the management of the paraplegic patient. The patients will benefit by a new ability to use the pneumatic orthosis during the early mobilization period, since it tends to prevent orthostatic hypotension, provides hip and trunk support and is readily available as a shelf item.

APPLICABILITY: It is likely that few functional ambulators will choose the pneumatic orthosis over the knee ankle orthoses as their permanent brace, but would rather use it during early mobilization and in some cases for exercise purposes.

Since the incidence of patients with spinal cord lesions is approximately 6,000 per annum, this study will be relevant to a large portion of those patients.

091 Nerve Conduction Measurement by the Use of Double Stimulus Technique

Principal Investigator:	Eugen Halar, M.D.	
FY 1976		
Status:	Completed	
Dates:	May, 1974-June, 1974	
Cost:	Annual $3,620 RT Annual $2,240	Projected Total $3,620 RT % of Annual Total 61%
Annual Report Reference:	#14, Page 200, R-115	

OBJECTIVES:

1. To reduce current errors in NCV measurement by establishing an exact and constant "take-off point" of the M response.
2. To improve the analysis of M response, as to its shape, size and temporarl dispersion in early, mild and severe neuropathies.
3. Exploring the possibilities of measuring Nerve Conduction Velocities of slow conducting nerve fibers.
4. Probe the validity of this technique for clinical use and its application for same.

METHODOLOGY:

1. Place pick-up electrodes on the distal muscle supplied by the nerve under test.
2. Place one set of stimulating electrodes on the proximal end and another set on the distal end of the nerve segment and connect each of these to two nerve stimulators.
3. Alternately a supramaximal stimulus is applied to the proximal and to the distal ends of the nerve at a constant rate, but outside of its refractory period.
4. The evoked M responses due to the two stimuli appear alternately on the oscilloscope.
5. Adjust the latency control knob till the take-off points of the M responses appear to be superimposed and note the reading of this control. This reading in milliseconds gives the latency for the fast nerve fibers.
6. If instead, the descending portions of the M responses are superimposed, the resulting latency allows the calculation of NCV of slow nerve fibers.
7. The two sets of stimulating electrodes are mounted on a calibrated expansion-bar from which the distance between the two can be accurately read off.
8. Measure the skin temperature with a skin surface thermometer before and after each test.
9. The M responses are recorded on photographic paper from which their amplitudes can be read off.
10. The temporal dispersion is determined by a consideration of the number of negatively directed spikes of the M response and also a count of the base line crossings of the M response spikes. It is hoped that by this technique the correlation between temporarl dispersion and NCV determination can be proved.

FINDINGS TO DATE: We have tested 24 subjects once a week for four to six weeks. Each subject has six peripheral nerves tested. A total of 580 nerve conduction velocity measurements were done and recorded. Preliminary calculations for day-to-day variations and left to right variations have been obtained. From a review of literature on the subject, the standard nerve conduction velocity technique was compared to the results obtained by the double nerve stimulus technique. It has been found that double nerve stimulus technique has significantly reduced the magnitude of error in serial nerve conduction velocity determination.

APPLICABILITY: Double Stimulation Technique should greatly improve the standard techniques used by **electromyographers** for the following reasons:

1. It will reduce the error rate of the Nerve Conduction Velocity determinations.
2. It will give more accurate assessment of the early neuropathies.
3. It would probably give pertinent data on slow conduction nerve fibers.
4. It will offer better electrodiagnostic assessment of the peripheral neuropathies in general, which affect some 10 to 20 million people in this country.

092 The Effectiveness of Instructional Units in Describing Architectural Barriers for Residence Selection

Principal Investigator:	**Marilyn B. Wittmeyer, O.T.R., B.A.**	
FY 1977		
Status:	**Completed**	
Dates:	**May, 1975-September, 1976**	
Cost:	**Annual $4,927** **RT Annual $3,857**	**Projected Total $4,927** **RT % of Annual Total 78%**
Annual Report Reference:	**#15, Page 254, R-117**	

OBJECTIVES:

a. Develop an instructional unit which when completed will allow the learner to:
Apply the information from the learning module to a practical selection of a living residence, and be more generally aware of architectural barriers when selecting a place of residence.

b. Evaluate whether training in the instructional unit will increase the ability of a subject to identify and select a suitable residence for wheelchair accessibility.

METHODOLOGY: The instructional unit consisted of 80 to 100 slides that were graphically illustrated interspersed with scenes of practical and real-life situations. A script was synchronized and recorded to provide audio for the slides. For practical purposes and the attention span of the audience, the module did not exceed 15 minutes.

Half the patients received numbers assigned to the control group and half received numbers assigned to the experimental group. The instructional unit was given to the experimental group.

Each patient evaluated a specified home for common architectural barriers that would be encountered in selecting this residence. The patients of the first group reevaluated the same residence after a period of one week. The second group was given the developed instructional unit under controlled conditions and then taken to the residences and the patients reevaluated the residence. A checklist was used as a rating and evaluating instrument by the investigator to assess the number of architectural barriers identified by the patient. The two group ratings were compared and matched.

FINDINGS TO DATE: Comparing data of the total items mentioned, using the t-test of the control and experimental groups, showed a difference in items gained which was significant at $p<.01$ level and indicated that the visual instructional module resulted in a significant increase in the number of items mentioned by the experimental group on the second visit as compared to the first visit. Also t-testing the number of items added on the second visit indicated significance at the $p<.01$ level. Therefore it was probable that the number of items added on the second visit was related to viewing of the visual instructional module.

A further need for information on wheelchair housing was apparent when using the visual module. The module has an accompanying booklet to describe the slides, but cannot be used without the visual module. A separate concise and illustrated booklet with similar information is planned.

APPLICABILITY: This module addresses the problems encountered in residence selection rather than public facilities. It is clear that this problem is just as relevant as the laws affecting public areas, since it may prevent many otherwise-qualified people from working.

093 Short Leg Bracing in Selected Cases of Crouch Gait

Principal Investigator:	**Morris R. Horning, M.D.**	
FY 1977		
Status:	**Completed**	
Dates:	**May, 1975-December, 1975**	
Cost:	**Annual $920** **RT Annual $920**	**Projected Total $920** **RT % of Annual Total 100%**
Annual Report Reference:	**#15, Page 105, R-121**	

OBJECTIVES:

A. Will demonstrate cosmetic benefits of rigid ankle short leg braces for the population that lacks active plantar flexion.

B. Determine energy requirements (in terms of 0_2 consumption) for walking with and without adequate bracing.

C. Will attempt to determine the biomechanical implantation for the crouched gait in this type of patient.

METHODOLOGY:

A. Will videotape selected patients with and without braces to demonstrate the cosmetic benefits.

B. Will perform 0_2 consumption studies on approximately 6 characteristic patients:
   1. with brace
   2. without brace with usual crouch gait
   3. without brace with straight leg gait

C. Will evaluate passive ankle range of motion (dorsiflexion) manually and in gait during stance phase to test the hypothesis that the passive mechanical limitation of dorsiflexion in stance phase provides a toe lever arm (i.e. a substitution of plantar flexion) which assists with balance.

FINDINGS TO DATE: Movies were done to demonstrate the characteristics of this gait problem. Slides were also made explaining the biomechanics, including the marked improvement shown using plastic short leg braces. The braces empirically provide significant improvement in gait and stance stability.

APPLICABILITY: Patients with this type of crouch gait who receive proper bracing will have improved cosmesis and reduced energy requirements, if the expected results are obtuined. Since there are large numbers of patients with meningomyelocele, cerebral palsy, developmental delay, and spinal cord injury who have this type of gait, many would be assisted by having this information in the hands of a physician.

094 A Comparison of Subjective Feelings of Pain with Impressions Obtained by Professional Personnel

Principal Investigator: **Bruce M. Gans, M.D.**
FY 1977
Status: **Completed**
Dates: **May, 1975-March, 1976**
Cost: **Annual $1,783** **Projected Total $1,783**
RT Annual $633 **RT % of Annual Total 35%**
Annual Report Reference: **#15, Page 214, R-123**

OBJECTIVES: In an attempt to determine the experiential factors contributing to the painfulness of the EMG examination, a prospective study was planned. The study goal was to identify who would be likely to experience greater levels of pain. We also wanted to determine the accuracy of the electromyographers' perception of the patients' pain experience.

METHODOLOGY: Each adult patient undergoing an EMG examination at the University Hospital over a three-month period was asked, immediately after leaving the office, to rate the severity of the pain experience on a scale of zero to four, where zero represented no pain and four, the most pain imaginable. No further definition of the scale was made. The electromyographer was also asked to rate the patient's pain behavior on the same scale, without knowledge of the patient's response.

EMGs were routinely performed with 28-gauge Teflon-coated monopolar needle electrodes in a windowless, soundproofed room with dim lighting. Room temperature was held constant at 72°F.

FINDINGS TO DATE: The data suggested that nerve conduction velocity studies are more uncomfortable for patients than needle EMG studies. The only other statistically significant factor appeared to be the patient's sex. All of the patients who raported no pain were male while 86% of the patients reporting maximum pain were females. The electromyographer's evaluation of the patient's pain perception was accurate in 84% of the cases.

APPLICABILITY: Results of this study have provided patient care personnel with a better understanding of the relationship between patients' subjective feelings of pain and the professional evaluation of pain perceived.

095 Electromyographic Feedback in the Training of Persons Who are Hemiplegic

Principal Investigator: **Martha Trotter, B.S.**
FY 1977
Status: **Completed**
Dates: **May, 1975-November, 1975**
Cost: **Annual $5,175** **Projected Total $5,175**
RT Annual $1,150 **RT % of Annual Total 22%**
Annual Report Reference: **#15, Page 163, R-124**

OBJECTIVES: To assess the usefulness of biofeedback in training a hemiplegic to: increase the electrical activity in a muscle, decrease the electrical activity in a spastic muscle, determine if the above two learned skills significantly influence the functional activities of the paretic extremities.

METHODOLOGY: Nine hemiplegic persons whose onset was no less than seven months previously were evaluated by a physical therapist for strength and coordination. Tasks were selected and using surface electrodes the patient tried, with the aid of biofeedback, to learn the tasks. Systematic measurements of the EMG response was made and recorded both in a pre-treatment or base line condition and then also during the treatment. Treatment consisted of 10-30 minute sessions working on each task with biofeedback. The patients were then again evaluated by the therapist and requested to submit a subjective report of their assessment of the effectiveness of training.

FINDINGS TO DATE: The data confirm the conclusions in the literature that persons can alter the electrical activity in a muscle.

Using the Brunnstrom hemiplegic assessment form, which measures the range of motion of the primitive limb synergics and identifies the ability of the hemiplegic person to deviate from these synergies, we found the subjects were most frequently successful at increasing the ROM in the pattern of the synergy but continued to be unable to activate the muscle to a functional skill level in a non-synergy pattern.

APPLICABILITY: As the biofeedback proved useful in muscle reeducation this technique will be used in that phase of the rehabilitation programs of stroke patients at the University of Washington Hospital. Primary advantages are ease of understanding the procedure and that the patient may train alone or with minimal supervision once the electrodes are in place. As no significant influence on functional skills was noted more traditional methods will be continued for functional re-training.

096 Postoperative Care of Patients with Total Hip Joint Replacement Using Ultrasound

Principal Investigator:	**Justus F. Lehmann, M.D.**	
FY 1977		
Status:	**Continuing**	
Dates:	**August, 1971-September, 1976**	
Cost:	**Annual $29,397** **RT Annual $28,017**	**Projected Total $69,759** **RT % of Annual Total 95%**
Annual Report Reference:	**#15, Page 37, R-2**	

OBJECTIVE: To assess whether ultrasound can be used safely in an area which has a prosthetic joint incorporating methyl methacrylate and high density polyethylene.

METHODOLOGY: An ultrasonic transmission line will be used to measure the acoustic properties of methyl methacrylate and the high density polyethylene. The longitudinal and shear velocities as well as the loss in the longitudinal shear modes will be calculated. The sample of methyl methacrylate will be prepared according to the directions supplied for preparing the materials for surgical use. Pieces of material will be machined to allow placement in the transmission line. Measurement of density will be made using the standard displacement technique and specific heat will be measured with a calorimetric method. The measurement of thermoconductivity will be made in a thermodynamic laboratory.

FINDINGS TO DATE: Because the described method for preparing methyl methacrylate causes rather gross nonuniformities in the individual samples, there was a wide variation in the shear and longitudinal velocity measurements. This was also true of the measurements of longitudinal and shear attenuation. These factors indicate that there is likely a large range in the estimated heating effects produced by ultrasound where methyl methacrylate is implanted.

The attenuation measured in the sample is not due solely to the absorption, but is rather caused by the combination of absorption within the sample and scattering due to inhomogeneities.

APPLICABILITY: Ultrasound application could be a valuable adjunct in the postoperative care of the total hip procedure. Vigorous application of ultrasound to heat the structure around the hip would increase rate of healing and possibly reduce pain, making the patient a functional ambulator in less time, if this technique is safe.

097 Program on the Quantitation of the Effects of Electromagnetic Energy on Human Tissue

Principal Investigator:	Arthur W. Guy, Ph.D.	
FY 1976		
Status:	Continuing	
Dates:	January, 1970-June, 1977	
Cost:	Annual $385,626 RT Annual $40,464	Projected Total $2,000,000 RT % of Annual Total 11%
Annual Report Reference:	#14, Page 36, R-5	
FY 1977		
Status:	**Continuing**	
Dates:	**January, 1970-June, 1977**	
Cost:	**Annual $422,074** **RT Annual $51,198**	**Projected Total $2,000,000** **RT % of Annual Total 12%**
Annual Report Reference:	**#15, Page 41, R-5**	

OBJECTIVE: To advance the existing knowledge on the quantitative effects of electromagnetic radiation on the human body and to provide realistic guidelines for safety standards of human exposure.

METHODOLOGY:

1. Establish quantitatively the electromagnetic field patterns both in and exterior to the tissues of human subjects and test animals due to external sources of energy.
2. Expose the test animals to the various CW and modulated electromagnetic sources at both thermal and nonthermal lower levels while monitoring the energy of the tissues.
3. Observe the physiological and behavioral characteristics of the animals before, during, and after exposure to electromagnetic radiation.
4. Determine the time and power density thresholds for cataract production in animals exposed to microwave radiation.
5. Determine what levels of fields mankind can be safely exposed to, taking into proper account the source, configuration, frequency, and location.
6. The theoretical analysis involves solution of Maxwell's equation for the absorbed power by biological systems for a host of different geometries.
7. The experimental studies involve controlled exposure of test animals to selected sources of electromagnetic energy with the aim of quantifying observable effects and changes on the biological systems.

FINDINGS TO DATE: Thermographic and thermocouple techniques have been used to measure the absorbed power and electric fields induced in the tissues of a wide variety of exposed animals and phantom models. All observed changes in the CNS of animals exposed to EM fields were found to be thermal in nature. The most pronounced effects appear to be latency changes in evoked brain potentials in cats exposed to EM fields. An experiment of chronic exposure with rats demonstrated rather conclusively the auditory nature of microwave behavioral control, and provides cogent evidence for the argument that microwave pulses activate the auditory sensory modality and no other sensory system at the incident power densities employed. No significant differences have yet been found between four irradiated and four normal animals in an attempt to discover the caractogenic effects of microwaves at certain levels of exposure. Additional experiments have concerned the effect of microwaves on lymphocyte cells and the amounts of microwave power which might be absorbed by human females and children (tested in phantom models) near leaking microwave ovens.

APPLICABILITY: Applicable to improved clinical techniques such as diathermy and certain newly possible uses in medicine of microwave. The use of microwave energy in industrial, scientific and medical applications have increased the population at risk to unknown side effects. The close contact of our laboratory with federal authorities and the international collaboration of scientists will make the setting of standards possible.

116

098 Severe Physical Disabilities of Unknown Etiology. (Former Title: Cellular Hypersensitivity Research Project)

Principal Investigator:	George H. Kraft, M.D.	
FY 1976		
Status:	Continuing	
Dates:	January, 1971-December, 1976	
Cost:	Annual $7,871	Projected Total $26,105
	RT Annual $7,871	RT % of Annual Total 100%
Annual Report Reference:	#14, Page 148, R-18	
FY 1977		
Status:	**Continuing**	
Dates:	**January, 1971-December, 1976**	
Cost:	**Annual $7,900**	**Projected Total $20,125**
	RT Annual $4,370	**RT % of Annual Total 63%**
Annual Report Reference:	**#15, Page 178 R-18**	

OBJECTIVES: To increase understanding of the cellular hypersensitivity mechanism and its role in disabling diseases by

(a) producing EAN in guinea pigs without (or with a minimum amount of) damage to the central nervous system.
(b) transferring this disease to recipient animals using lymph node lymphocytes.

METHODOLOGY:

1. Techniques have been developed for extracting peripheral nerve antigen and studying the time factor between injections of antigen and development of electrophysiologic abnormalities in peripheral nerves.
2. Cellular hypersensitivity involves extraction of synovial antigen which produces synovitis (arthritis).
3. Experimental diseases will be produced and studied in animals.

FINDINGS TO DATE: During the past year we have attempted to transfer EAN from several donor rats of an inbred strain to recipient rats of this same strain using suspensions of donor lymphoid cells. However, the recipient animals failed to develop any of the signs of EAN (weakness, weight loss, paralysis) although they were closely examined clinically for three weeks following cell transfer. The methodology for these experiments will be improved, and they will be continued.

We have also examined the ability of adjuvant materials, alone and in combination with non-nervous tissues, to produce symptoms which are similar to EAN clinically. Previous experiments had given us reason to suspect that EAN was being produced in occasional control animals. However, by increasing the concentration of mycobacteria in the adjuvant, we were able to produce a more severe granuloma at the site of injection but never clinical signs of EAN. We are now satisfied with our control procedures.

APPLICABILITY: Current preliminary studies of passive transfer of immune disorders have been expedited by the data made available from detailed investigation of Experimental Allergic Neuritis (EAN) in guinea pigs. Specific problems such as dosage, routes of injection and location of high lymphocyte (immune cell) concentration in diseased subjects have been examined. Moreover, information obtained from these studies has led to the credibility of EAN as a laboratory model for Guillain-Barre or Idiopathic Polyneuritis, a human disease of peripheral nerves leading, usually, to acute temporary impairment of motor function.

099 Severe Disabling Polyneuritis of Unknown Cause: The Development of a Research Model. (Former Title: Experimental Allergic Neuritis in the Guinea Pig)

Principal Investigator:	George Kraft, M.D.	
FY 1976		
Status:	Continuing	
Dates:	January, 1972-December, 1976	
Cost:	Annual $6,100 RT Annual $6,100	Projected Total $20,125 RT % of Annual Total 100%
Annual Report Reference:	#14, Page 151, R-19	
FY 1977		
Status:	**Continuing**	
Dates:	**January, 1972-December, 1976**	
Cost:	**Annual $9,187** **RT Annual $6,657**	**Projected Total $22,137** **RT % of Annual Total 72%**
Annual Report Reference:	**#15, Page 182, R-19**	

OBJECTIVES: To explore the relationship between experimental allergic neuritis and Guillain-Barre polyneuritis and to investigate means of therapeutic management and prevention of the disease.

METHODOLOGY:

1. Experimental allergic neuritis is induced in guinea pigs by a single intradermal injection into front footpads of an emulsion of peripheral nerve antigen in combination with killed mycobacteria in oil, an adjuvant which enhances the immune response.
2. The ensuing disease process, with clinical manifestations emerging on about day 14, is monitored in a variety of ways. Clinical observations, including the recording of weight and temperature (at the inside surface of the ankle) along with more subjective assessments of weakness and paralysis are made biweekly and with daily recording during the acute phase. Electrophysiologic examinations for indications of nerve function are performed twice weekly as well.
3. Further information is made available through the sacrifice of selected animals for routine and specialized histologic studies.

FINDINGS TO DATE: During the past year we have demonstrated that the ability of the Lewis (inbred) rat to develop EAN is dependent on the dose of mycobacteria used in Freund's complete adjuvant (FCA) which in combination with peripheral nerve is effective in producing EAN in the Lewis rat while rat peripheral nerve alone is not. Using the appropriate doses of mycobacteria in FCA and guinea pig peripheral nerve, EAN was produced in 100% of the juvenile Lewis rats injected. The course of the disease was monitored in these animals by measuring the conduction velocity of the nerves in the tail. This provided physiological information about the development of the disease which supplemented our daily clinical examination of weakness in diseased animals. This same type of experiment is currently being repeated in adult animals.

APPLICABILITY: As a result of this and other studies, Experimental Allergic Neuritis has gained a high degree of credibility as a close and genuine model for the human Gjillain-Barre syndrome. Information derived from this study, accessible to a large number of physicians and specialists in rehabilitation through presentations and publications, will be of use in treating the human disorder.

100 Mechanism and Treatment of Muscle Contracture in Disabling Diseases.

Principal Investigator:	**Walter C. Stolov, M.D.**	
1977		
Status:	**Continuing**	
Dates:	**September, 1971-September, 1979**	
Cost:	**Annual $37,476** **RT Annual $21,801**	**Projected Total $130,952** **RT % of Annual Total 60%**
Annual Report Reference:	**#15, Page 228, R-24**	

OBJECTIVES: To simultaneously determine total muscle length, individual fiber length, number of sarcomeres, and length of tendon aponeurosis of insertion and origin in rat gastrocnemius and soleus muscle in which clinical contracture of normal and denervated muscle is produced.

METHODOLOGY: Fifteen adult rats will be weightmatched and divided into 3 groups of 5. One group will be sacrificed immediately to represent initial condition, one will be immobilized via Plaster of Paris cast and the third group will be sacrificed at 5 weeks. The calcaneous of all the muscles will be separated from the feet, the gastrocnemius muscle will be separated from the soleus and the soleus muscles will be loaded with fifteen grams of passive tension. When the weights are loaded on the anesthetized animal the length of the muscle will be fixed by a perfusion of the animal with gluteraldehyde through the aorta. The soleus muscle will be dissected out and frozen on microtome stages and sectioned.

FINDINGS TO DATE:

A. Immobilization contracture as far as the whole belly length was concerned was an arrest of growth.

B. Arrest of growth also occurred in the insertion aponeuroses plus an absolute reduction in insertion aponeurosis length.

C. Anterior muscle fiber, posterior muscle and a sarcomere number were all arrests of growth when contracture was produced.

D. Growth rates for belly length, origin and insertion aponeuroses and length of muscle fiber and sarcomere number were more directly related to body weight and were the same for all structures.

E. Immobilization contracture, therefore, was largely growth arrest plus an absolute reduction in insertion aponeuroses length with some increase in poterior muscle fiber length and hence an architectural rearrangement.

APPLICABILITY: Muscle contracture secondary to positioning is best reversed by chronic positioning of the muscle in the elongated posture. Tendon lengthening procedures should be very carefully considered in the face of muscle contracture. In all growing patients with conditions productive of contracture, meticulous periodic posturing of the offending muscles in the elongated posture should inhibit the development of contracture and subsequent loss of functional ability.

100-A. Length Changes in Tendon Aponeurosis of Origin and Insertion in Muscle Fibers in Soleus Immobilization Contracture

Principal Investigator:	Walter C. Stolov, M.D.	
FY 1976		
Status:	Continuing	
Dates:	September, 1971-September, 1976	
Cost:	Annual $20,277 RT Annual $10,007	Projected Total $78,468 RT % of Annual Total 49%
Annual Report Reference:	#14, Page 212, R-24, IV, Part A	

100-B. Denervation Hypertrophy

Principal Investigator:	Walter C. Stolov, M.S.	
FY 1976		
Status:	Continuing	
Dates:	September, 1971-September, 1976	
Cost:	Annual $20,817 RT Annual $10,467	Projected Total $52,484 RT % of Annual Total 51%
Annual Report Reference:	#14, Page 218, R-24, IV, Part B	

OBJECTIVE: To simultaneously determine total muscle length, individual fiber length, number of sarcomeres, and length of tendon aponeurosis of insertion and origin in rat gastrocnemius and soleus muscle in which clinical contracture of normal and denervated muscle is produced.

METHODOLOGY:

1. For 5 weeks a plaster cast will immobilize one leg of a rat as well as hold the knee and ankle into knee flexation and ankle plantar flexation in order to produce clinical contracture in the gastrocnemius and the soleus. The immobilized muscle will be denervated by high sciatic section.
2. The plaster casts will be removed after 5 weeks of immobilization. The heel bones of both the immobilized leg and the opposite immobilized leg will be separated from the foot and tied to weights of 25-50 grams when the soleus is being studied and 50-100 grams when the gastrocnemius is being studied.
3. While the animal is anesthetized and the weights loaded on both muscles of both legs the length of the muscle under weight load will be fixed by perfusion of the animal through his aorta with gluteraldehyde mixed with procaine. In this way the length of the experimental and the control are fixed at the same tensions and can be compared with regard to contracture.
4. The muscles are dissected out, mounted, and cut longitudinally without disturbing the architectural relationship that existed at the time of fixation. Muscle length will be determined by diffraction patterns that are produced by laser beam directed at the specimen mounted on a slide. Muscle fiber length and length of the tendon aponeurosis will be mounted directly on the slide after appropriate staining. Number of sarcomeres will be obtained from the length of the fiber.

PROGRESS AND FINDINGS:

1. The technique for aorta perfusion and muscle dissection has been developed.
2. The technique for muscle mounting, cutting, and staining in a way that cellular structure is not disturbed is in progress.
3. The technique for sarcomere measurement via laser beam is being developed.

101 Quantification of the Biomechanical Function of Various Designs and Adjustments of Ankle Foot Orthoses. (Former Title: Evaluation of Ankle-Foot Orthosis Applications to Hemiplegic Patients)

Principal Investigator:	Justus F. Lehmann, M.D.	
FY 1976		
Status:	Continuing	
Dates:	January, 1969-December, 1975	
Cost:	Annual $37,301 RT Annual $30,552	Projected Total $112,202 RT % of Annual Total 80%
Annual Report Reference:	#14, Page 78, R-34	
FY 1977		
Status:	**Continuing**	
Dates:	**January, 1969-December, 1977**	
Cost:	**Annual $34,183** **RT Annual $26,759**	**Projected Total $112,202** **RT % of Annual Total 78%**
Annual Report Reference:	**#15, Page 84, R-34**	

OBJECTIVE: To evaluate the biomechanics of various foot ankle orthoses and their safety and effect on hemiplegic gait.

METHODOLOGY: A transducer is used which measures the movements about the ankle joint and can be applied to the patient's orthoses without modification. A large number of hemiplegic patients have been sampled. Static testing is done to determine what reactive forces are provided by the various orthotic designs. The reactive forces from the force plate are used in conjunction with the location of the medio-lateral axis of rotation. The medio-lateral stability provided by the orthosis is evaluated; the knee stability is evaluated using the force vector from the floor combined with measurement of the axis of rotation of the knee joint.

PROGRESS AND FINDINGS:

1. Transducer assemblies which measure the movements about the anatomical axis of the ankle have been designed.
2. The complimentary measurement of floor reactive forces has been delayed.

3. Major efforts have been made to establish a vibration-free situation with parallel efforts to design instrumentation which could perhaps be used in the mechanically noisy environment.
4. This study will continue to lag approximately six months behind schedule.

APPLICABILITY: Since improved ability to walk could greatly enhance the rehabilitation of hemiplegic patients, these findings will have wide utilization in the management of stroke patients as well as in management of other upper motor neuron lesions requiring foot-ankle orthosis.

102 The Semantic Analysis of Clinical Pain

Principal Investigator:	W. E. Fordyce, Ph.D.	
FY 1976		
Status:	Continuing	
Dates:	January, 1968-December, 1975	
Cost:	Annual $1,398 RT Annual $1,168	Projected Total $2,950 RT % of Annual Total 83%
Annual Report Reference:	#14, Page 122, R-67	
FY 1977		
Status:	**Continuing**	
Dates:	**January, 1968-July, 1976**	
Cost:	**Annual –** **RT Annual –**	**Projected Total $2,950** **RT % of Annual Total –**
Annual Report Reference:	**#15, Page 128, R-67**	

OBJECTIVES:

1. To test whether patients who are judged as having "organic" or "nonorganic" basis for their pain are different in the semantics of their pain descriptions;
2. to test whether patients who recline versus those who pace when pain is active differ in either the semantic descriptions of their pain or in their MMPI scales score;
3. to test whether either the MMPI or the activity measures (uptime, downtime) differ as a function of physician ratings as to "organic" or "nonorganic."

METHODOLOGY:

1. One hundred consecutive medical charts from patients referred with problems of chronic pain and from whom diary forms, semantic differentials, and MMPIs had been obtained, were reviewed.
2. All medical diagnostic terms recorded in their charts were listed on summary cards. These 100 cards were then sorted into forced normal distributions by five physicians and one psychologist along a continuum ranging from "organic" to "nonorganic." The mean physician ratings constitute a "medical consensus" classification as to the extent to which each patient's pain is judged to be presently under control of organic factors.
3. Data analysis consists of (a) tests to compare uptime and MMPI means of the various patient subgroups defined above; (b) Pearson product moment correlation between activity measured and semantic differential measures; and (c) discriminate analysis to evaluate interrelationships among the variables.
4. Two groups of 25 patients falling at each extreme in ratings on the "organic-nonorganic" continuum were also defined and compared for MMPI scores, and activity measures. Data analysis included t-tests, discriminate analyzing and correlations.

PROGRESS AND FINDINGS: Data analysis has been completed and papers published. An additional paper is in preparation.

APPLICABILITY: If it can be shown that there are semantic relationships between verbal report data from patients or MMPI profiles and either the medical consensus classifications or the activity levels of pain patients, the diagnostic process of clinical pain can be considerably simplified.

103 Motor Point Blocks Phase III

Principal Investigator:	Barbara J. DeLateur, M.D.	
FY 1976		
Status:	Continuing	
Dates:	July, 1973-July, 1976	
Cost:	Annual $7,667 RT Annual $1,736	Projected Total $23,375 RT % of Annual Total 22%
Annual Report Reference:	#14, Page 227, R-92	
FY 1977		
Status:	**Continuing**	
Dates:	**July, 1973-July, 1977**	
Cost:	**Annual $8,403** **RT Annual $1,736**	**Projected Total $23,375** **RT % of Annual Total 21%**
Annual Report Reference:	**#15, Page 234, R-92**	

OBJECTIVES:

1. To determine appropriate voltages for precise localization of motor nerves;
2. To correlate lesion size with magnitude and duration of temperature;
3. To determine and improve the accuracy of localization of the lesion for studying, histologically, the character, evolution, and duration of the lesion.

METHODOLOGY: The motor end plates and small intramuscular nerves will be localized in guinea pigs. An electrosurgical system suitably interfaced with probing needles will be utilized to deliver a low output current to the motor points and small intramuscular nerves.

The animal is sacrificed after two days to get good necrosis and inflammation. The gastrocnemius muscles are excised and placed in formalin. The Holmes Nerve Fiber stain is used to determine what the site and size of the damage is and whether the nerve itself has been affected. A functional test of damage to the live animal will not be done at this time since these are acute lesions and any damage seen might be due to soreness.

The lesion should be of the nerve, leading to wallerian degeneration, and to atrophy (not necrosis) of the muscle.

FINDINGS TO DATE: The surgical electrocautery which was provided free of charge by the 3M Company was capable of making a lesion, but the precision of the localization and degree of temperature monitoring and determination of lesion size was insufficient and inappropriate for creating this type of lesion in human subjects. Therefore a Radionics RFG-3AV radio frequency lesion generator with tissue temperature monitoring electrodes was acquired.

The animals were sacrificed after five days. Histology was done on the muscles; two slides were made of each of the four muscles. The lesions (which were large enough to be seen without the microscope) occupied a large area, but no damaged nerves were seen.

APPLICABILITY: If the option of a permanent motor point block becomes available to handicapped patients, it will mean that they can have relief without interrupting their work or activities every 4 to 6 months to return for repeat blocks. This is of particular relevance to those who live a great distance from a center where blocks are performed.

104 Temperature Measurement in the Human Thigh During the Application of Hot or Cold Packs, Followed by Ultrasound

Principal Investigator:	Justus F. Lehmann, M.D.	
1976		
Status:	Continuing	
Dates:	October, 1973-October, 1976	
Cost:	Annual $28,988 RT Annual $18,104	Projected Total $79,525 RT % of Annual Total 62%
Annual Report Reference:	#14, Page 59, R-103	

FY 1977
Status: **Continuing**
Dates: **October, 1973-October, 1976**
Cost: **Annual $35,085** **Projected Total $87,477**
RT Annual $24,850 **RT % of Annual Total 71%**
Annual Report Reference: **#15, Page 66, R-103**

OBJECTIVES: To determine the effect of sequential application of hot packs and ultrasound and to determine the effect of precooling the surface of the tissue prior to ultrasound treatment.

METHODOLOGY:

1. Normal volunteers would be utilized.
2. Temperature measuring probes would be placed in the anterior-lateral aspect of the thigh with the sensing elements located at the midline of the thigh adjacent to the femur.
3. In each of the five groups, three treatments would be evaluated. The first would involve application of hot packs for 20 minutes, the application of ultrasound at two tolerance levels. Next the sequence would be changed such that ultrasound would be applied first and hot packs second. Finally, ice packs would be applied for a period of 10 minutes prior to the application of ultrasound at frequencies equalling tolerance levels.

FINDINGS TO DATE: Temperature distributions were obtained in six human subjects after preheating for eight minutes with a hot pack followed by approximately fifteen minutes of ultrasound. Ultrasound was applied with a stroking technique and room-temperature mineral oil was used as the coupling agent.

After treatment with the hot pack the skin surface temperatures were elevated about 43°C. When the hot pack was removed surface temperature immediately dropped and was found to be the lowest temperature measured throughout the tissue. Needles that were placed in close proximity to the bone (3mm.) showed significant increases in temperature to 42°C. Surface temperatures and subcutaneous fat temperatures were slightly elevated above the levels obtained when no hot packs were applied.

From these curves it appears that overheating the skin surface when hot packs are used before an ultrasound treatment is not likely.

APPLICABILITY: A large proportion of the therapeutic heat treatments given are some combination of superficial heating or cooling with deep heating using ultrasound. If in fact the deep temperature can be elevated more effectively by the sequential application of superficial heating or cooling in conjunction with ultrasound, this type of treatment would become more desirable for use on patients.

105 Gastrocnemius Muscle and Tendon Length in Normal and Stroke Patients

Principal Investigator: Eugen M. Halar, M.D.
FY 1976
Status: Continuing
Dates: December, 1973-June, 1976
Cost: Annual $5,049 Projected Total $15,000
RT Annual $3,462 RT % of Annual Total 68%
Annual Report Reference: #14, Page 230, R-104
FY 1977
Status: **Continuing**
Dates: **December, 1974-December, 1978**
Cost: **Annual $9,648** **Projected Total $17,166**
RT Annual $8,165 **RT % of Annual Total 85%**
Annual Report Reference: **#15, Page 237, R-104**

OBJECTIVES: To develop a reliable technique that could accurately measure muscle belly and tendon length changes during different active or passive ankle ranges of motion.

To determine whether loss of passive dorsiflexion in a stroke syndrome is due to a shortening of the muscle belly, or of the tendon, or both.

METHODOLOGY:

1. Human gastrocnemius muscle belly and tendon lengths will be determined through the use of ultrasound echography at several points on the leg.
2. Both normal subjects and stroke patients of varying age groups will be measured when their legs are both passively dorsiflexed and relaxed. This will establish a tension length diagram.
3. Elasticity as a function of age will be measured through the determination of muscle belly and tendon lengths at several passive tensions.
4. Ten consecutive measurements of a single limb under a single passive tension will determine how many scans should be made for any single subsequent measurement. A normal young adult group (ages 20-30) and a normal older group (ages 55-65) will be compared for right-left leg variations and age variations and will be matched according to lower limb length.
5. Fifteen to 20 patients having suffered unilateral stroke syndrome will receive prolonged passive stretching and measurement of their right and left leg with the opposite serving as control, for 20 minutes, twice a day and lasting a period of 3-4 months. These patients will be compared to each other and the normal group.
6. It was decided to test 60 subjects, 30 normals and 30 stroke patients for the part of the study regarding shortening and elongating properties of the gastrocnemius muscle. An additional 30 stroke patients will be tested for the treatment of the gastrocnemius muscle contracture.

FINDINGS TO DATE:

A. We have obtained measurements of the gastrocnemius muscle belly and tendon length change in the normal group of subjects.

B. The measurements of the gastrocnemius muscle belly and tendon length changes for the different age groups of normal subjects revealed that there is no statistical difference in the magnitude of elongation among different age groups of normal subjects. The older age group showed the same values of elongation as younger subjects.

C. In the hemiplegic groups of subjects:

1. Elongation during passive tension occurred in the muscle belly only, but not in the muscle tendons, regardless of whether gastrocnemius muscle was spastic or flaccid.
2. The magnitude of gastrocnemius muscle belly length change on progressive passive tensions was significantly different only between the normal and nonhemiplegic legs and between normal and hemiplegic legs of the stroke patients. This indicates that both gastrocnemius muscles of the stroke patients are not normal with respect to passive elongation.
3. Spastic muscle belly elongates less on the smaller than on the larger passive tension. Also, the spastic muscle belly elongates less than the nonhemiplegic gastrocnemius muscle does on the smaller passive tensions. However, the total amount of muscle belly elongation is of the same magnitude in both nonhemiplegic and hemiplegic gastrocnemius muscles. The significance of this is very easily overlooked since it indicates that the clinically found ankle joint contracture in all our tested spastic hemiplegic legs of the stroke patients has not been true or actual.

APPLICABILITY: Effective prevention and management of joint contracture is a question that is raised daily on Rehabilitation Medicine Services, or any other medical service dealing with chronically sick and disabled patients. The scarcity of published data in the Rehabilitation Medicine literature leads one to believe that much of the conservative and surgical treatment is done on an empirical basis. Knowledge about the basic mechanism of how live muscle becomes permanently shortened if not used would enlighten our conservative and surgical treatment of joint contractures.

106 Footwear and Posture: Phase I-V

Phase I: Static Effects on the Lumbar Lordosis
Phase II: Dynamic Effects on the Lumbar Lordosis
Phase III: Dynamic Effects on Longitudinal Arch of the Foot
Phase IV: Long Term Effects on the Feet and Back
Phase V: AlterNation of Metabolic Demands

Principal Investigator:	Barbara DeLateur, M.D.	
FY 1976		
Status:	Continuing	
Dates:	May, 1974-September, 1977	
Cost:	Annual $1,925 RT Annual $959	Projected Total $2,100 RT % of Annual Total 49%
Annual Report Reference:	#14, Page 88, R-107	
FY 1977		
Status:	**Continuing**	
Dates:	**May, 1974-September, 1977**	
Cost:	**Annual $5,049** **RT Annual $4,083**	**Projected Total $2,100** **RT % of Annual Total 31%**
Annual Report Reference:	**#15, Page 91, R-107**	

OBJECTIVES:

Phase I: To study quantitavely what effect the heel height of footwear has on the lumbar lordosis when subjects are standing.

Phase II: To study quantitatively what effect the heel height of footwear has on the lumbar lordosis, the hip, and knee, when subjects are walking.

Phase III: To determine the short-term effects of heel height upon the angles between the bones of the foot (especially the longitudinal arch).

Phase IV: To determine long-term beneficial or detrimental effects of negative heel footwear upon the feet and back.

Phase V: To determine metabolic demands of different types of footwear.

METHODOLOGY:

Phase I: Polaroid photographs were taken with subjects in bare feet, low heels, and earth shoes (men); or bare feet, high heels, and earth shoes (men); or bare feet, high heels, and earth shoes (women).

Lateral photographs were repeated five times in each position and the average intersecting angles and the standard deviation made. Kottke landmarks on the anterior superior iliac spine and posterior superior iliac spine were placed and a tape drawn between those landmarks. To that line a perpendicular was dropped to the greater trochanter. Also, a tape was placed connecting the lateral epicondyle of the femur with the greater trochanter. Thus, the true angle of the hip was measured and recorded. This served as an orienting landmark for the photography, to aid in reproducibility of the method.

Phase II: Electrogoniometry will be used to measure the angles of the low back, the hips, knees and ankles instantaneously throughout the gait cycle with subjects in bare feet (providing the normative data), negative heels, and positive heels of various heights.

Phase III: Subjects with normal or hypermobile flat feet will have cineradiographic films made of their feet as they walk on the treadmill in bare feet, negative-heel and positive-heel footwear. These motion-picture X-Rays permit statistical analysis of the angles between the bones of the feet at all phases of the gait cycle of normal and flat feet in the various footwear to determine whether the long arch is "levered open" in negative footwear.

Phase IV: A simple questionnaire regarding type of shoes worn most of the time and presence or absence of back pain and/or footpain is filled out by telephone. Subjects are telephoned every six months for a minimum of two years.

Phase V: Oxygen consumption studies will be made of subjects in bare feet, negative-heel shoes, low-heeled shoes of comparable weight, and high heeled shoes, at varying level speeds, and with varying inclines on the treadmill.

FINDINGS TO DATE: Phase I was completed and submitted for publication to the **Archives of Physical Medicine and Rehabilitation.** The instrumentation for Phases II and V is almost complete for electrogoniometry and O_2 consumption studies. One normal and one flat-footed subject have been studies in Phase III. The numerous cine-radiographs are being analyzed one by one. Data is being collected at six-month intervals in Phase IV by telephone survey from volunteer subjects.

APPLICABILITY: Mechanical or postural low back pain is associated with bad posture — mainly increased lumbar lordosis. High heels are said to increase this lumbar lordosis and aggravate such low back pain (although the published studies do not fully document this). Negative heel shoes, on the other hand, have a flat heel and are raised in the front, thus are said to improve the posture, so claim the manufacturers of the shoes. If negative heel shoes decrease the lumbar lordosis, they might be able to help postural low back pain.

Consumers of the results will be very widespread. A large number of students are wearing negative heel shoes. Until the results of Phases II, III, and V are in, no specific recommendations will be made. The results of this study will result in clearer concepts of use to the practicing physiatrist, orthopedic surgeon, and general practitioner of the effects of shoe-wearing on mechanical low back pain.

107 A Controlled Study of the Use of Temperature Feedback for the Treatment of Raynaud's Disease

Principal Investigator:	Roy S. Fowler, Jr., Ph.D.	
1976		
Status:	New	
Dates:	June, 1975-June, 1977	
Cost:	Annual $11,302 RT Annual $10,152	Projected Total $31,623 RT % of Annual Total 89%
Annual Report Reference:	#14, Page 132, R-108	
FY 1977		
Status:	**Continuing**	
Dates:	**January, 1975-January, 1978**	
Cost:	**Annual $12,456** **RT Annual $11,111**	**Projected Total $37,368** **RT % of Annual Total 89%**
Annual Report Reference:	**#15, Page 138, R-108**	

OBJECTIVES:

1. To test the effectiveness of feedback temperature training introducing voluntary handwarming in patients suffering from Raynaud's Disease and Raynaud's phenomenon.
2. To test the long term effectiveness of the training procedures.
3. To identify the role of the placebo in biofeedback treatment programs for Raynaud's Disease.

METHODOLOGY: Subjects diagnosed as having Raynaud's disease and Raynaud's phenomenon by medical evaluation will be referred for biofeedback treatment. Twenty subjects will be randomly divided into two groups. Group one will be the Treatment Group. They will receive eight weeks of feedback training with sessions scheduled twice a week, each session will last 30 minutes. Treatment procedures to be followed are described in detail in reference #5. Group two will be the Control Group. These subjects will receive a bogus or noncontingent feedback for eight weeks. Feedback played to subjects will be derived from the records of previously successful subjects. An average pattern will be recorded on tape and played through the feedback device to the subject.

Records will be kept of intensity of pain, frequency of discomfort and medication intake. Treatment effectiveness will be evaluated on the basis of voluntary control of finger tip temperature, decrease in pain medication records and frequency and intensity of discomfort. At the end of the eight weeks of active treatment all subjects in the control group will be offered feedback treatment. Each subject will be followed for a minimum of one year with contact occurring at four month intervals.

FINDINGS TO DATE: The number of patients referred to treatment far exceeded our initial expectations. To date 25 patients have completed training and have received 1-5 follow-up visits. The longest follow-up on any patient has been one year. Two patients are currently in training and another is scheduled to start training. In order to complete our follow-up desires, this will be regarded as the end of patient training.

Four subjects have dropped out during training. To date, all but one of the patients completing training have reported some benefits. This benefit range from slight and occasional improvement to considerable improvement related with great enthusiasm. The patients range in ages from 8-66 years. Virtually all patients learned how to successfully warm their fingertips on command. Pain records, hours of work missed, and after Doppler's studies of circulation, medication intake, records and ratings of fingertip temperature have been collected and are to be subjected to statistical analysis.

APPLICABILITY: It has been estimated that Raynaud's disease or its symptoms affect approximately 20% of most young people in its mildest form. In its most severe form, frequently connected with other identifiable pathological processes, amputation of fingers and toes is observed. Medical treatment has been defined at best as "providing only partial relief." Surgical procedures such as sympathectomies and potential dangerous vasal dialating drugs are not uniformly successful and the side effects are potentially dangerous. Biofeedback treatment procedures hold considerable promise as a safe patient controlled treatment program for this sometimes severely disabling disease. It is anticipated that biofeedback will become the treatment of choice for the early management of Raynaud's symptoms. It will be chosen as an alternative to medication and/or surgical procedures.

108 The Effectiveness of EMG Muscle Relaxation Training as a Function of Feedback Mode and the Muscle Trained

Principal Investigator: Roy S. Fowler, Jr., Ph.D.
FY 1976
Status: Continuing
Dates: June, 1974-June, 1975
Cost: Annual $16,170 Projected Total $16,170
RT Annual $16,170 RT % of Annual Total 100%
Annual Report Reference: #14, Page 136, R-109
FY 1977
Status: Continuing
Dates: January, 1976-January, 1978
Cost: Annual $17,817 Projected Total $38,000
RT Annual $17,817 RT % of Annual Total 100%
Annual Report Reference: #15, Page 142, R-109

OBJECTIVES:

1. Develop standardized replicable EMG based feedback procedures for muscle relaxation training.
2. Test the differential effectiveness of these treatment procedures.
3. Test the relationship between type of muscle trained and the feedback procedure used.
4. Test the effect of a technician's presence in influencing treatment.
5. Develop treatment equipment which will reduce manpower needs and treatment costs.

METHODOLOGY: Three muscles will be targeted for relaxation training. These include the frontalis, which has been said to be most important in the treatment of tension headache; the trapezii, often involved in shoulder/back problems and the cervical para-spinals which are thought to play a role in both tension headache and neck and shoulder problems.

Four EMG feedback procedures will be employed. These include: A) analog feedback in which feedback is provided by a meter which indicates tiny changes in muscle tension or relaxation; B) shaping, in which subjects will first receive a baseline score. This score will represent the microvoltage output for three consecutive 10 second trials without feedback. The average of these trials will be calculated and this score used as a starting point for training. Subjects will be asked to achieve this score. If they do so they will turn on a green light and trip a counter which will record the percentage of each 10 second trial during which the green light is on or the subject has relaxed below his initial baseline level. An 85% success criterion will be used. Adjustments will be made to the trip point selection following each successful trial so as to demand greater and greater relaxation per trial. C) automated feedback shaping procedures in which feedback to the subject will be essentially identical to that received in mode B except the process will be totally automated. All instructions will be provided through a digital readout from a TV monitor. The subject will control his own pace. Recording of results will be automatic. Another person will be involved only to place and remove electrodes; D) Control in which noncontingent or "bogus" feedback will be provided in the form of a visual analog. The feedback will be provided by a tape recording of EMG signals from successful subjects. This tape recording will be played through the meter in such a way as to suggest to the subject that he is obtaining feedback from his own muscles.

FINDINGS TO DATE: A unique automated EMG training laboratory has been designed and constructed. 81 of 90 subjects have completed testing. Data are yet to be analyzed following completion of the project.

APPLICABILITY: This study will provide information which will allow for the development of more effective disability reducing treatment procedures. It should also increase the success rates of biofeedback treatment programs, increase replicability of results across institutions utilizing such procedures, increase the general effectiveness of biofeedback treatment programs, and significantly reduce the need for the use of potentially dangerous drugs and/or destructive surgical procedures.

109 An Automated Nerve Conduction Velocity Device

Principal Investigator:	George H. Kraft, M.D.	
FY 1975		
Status:	New	
Dates:	July, 1974-December, 1975	
Cost:	Annual $2,407	Projected Total $5,000
	RT Annual $1,395	RT % of Annual Total 57%
Annual Report Reference:	#14, Page 197, R-111	
FY 1977		
Status:	**Continuing**	
Dates:	**July, 1974-December, 1976**	
Cost:	**Annual $8,625**	**Projected Total $12,625**
	RT Annual $575	**RT % of Annual Total 6%**
Annual Report Reference:	**#15, Page 211, R-111**	

OBJECTIVES: To develop a simple, inexpensive automated device to determine nerve conduction velocities in humans and to evaluate the accuracy and clinical effectiveness of this device.

METHODOLOGY: The theoretical concept for the nerve conduction velocity meter was developed by Dr. Kraft and the instrument was technically designed and fabricated by Mr. James Rounds. Following the successful completion of the prototype 20 normal subjects will be evaluated with regard to comparing conventional means of measuring nerve conduction velocity device in the median nerve with those values obtained by the nerve conduction velocity meter. Each subject will have his or her median nerves studied with both the conventional and the new methods and values will be compared, using the conventional techniques as standards. Ease of testing, time required for testing and patient tolerance will be evaluated. Repeated studies will be done by both conventional and the nerve conduction velocity meter techniques to see whether there is more consistency in the new technique than in the conventional techniques. Because all standards of nerve conduction velocity are determined at the present time by conventional techniques, an average set of values from conventional techniques will be used as the standards.

FINDINGS TO DATE: During FY 1976, several small modifications were made in the original prototype and the nerve conduction velocity meter evolved as a device which could be used in the laboratory to test the principal of the integrated nerve conduction velocity meter vs. conventional nerve conduction velocity techniques. The device has been proven reliable. Engineering and technical improvements continue to be made as the clinical evaluation of the device was planned. During the year, only preliminary clinical testing was done. An invention disclosure was made during the year which included a general description of the apparatus.

Our preliminary tests indicated that the NCV meter was sensitive enough to respond to changes in temperature which affect nerve conduction velocity and was accurate enough to yield an error of less than one percent on successive NCV examinations on suitable subject.

During this past year a grant proposal was written by Dr. Kraft and Mr. Freal and approved by RSA for further evaluation of the NCV meter on normal subjects and patients with end stage renal disease. To avoid duplicate funding for the same work the NCV meter was discontinued as an R&T project.

APPLICABILITY: It is expected that this device will find widespread use throughout medical practice in screening patients with peripheral neuropathies. Its advantage over existing equipment will lie with the increased speed of determination and greater accuracy resulting from the further elimination of human error from the procedure. We also anticipate that the new automated device will cost considerably less to manufacture than the currently available instruments used to measure nerve conduction velocities.

110 Evaluation of Wheelchair Designs for Quadriplegic and Paraplegic Patients

Principal Investigator:	Justus F. Lehmann, M.D.	
FY 1976		
Status:	Continuing	
Dates:	June, 1974-January, 1976	
Cost:	Annual $9,609 RT Annual $7,889	Projected Total $19,067 RT % of Annual Total 82%
Annual Report Reference:	#14, Page 99, R-114	
FY 1977		
Status:	**Continuing**	
Dates:	**June, 1974-September, 1978**	
Cost:	**Annual $12,434** **RT Annual $10,597**	**Projected Total $38,302** **RT % of Annual Total 85%**
Annual Report Reference:	**#15, Page 102, R-114**	

OBJECTIVES: The objective of this study is to define the design parameters necessary to produce a powered reclining wheelchair which will not cause displacement or shear on the body of a quadriplegic or severely paralyzed individual.

METHODOLOGY: Strain gauge instrumentation has been developed to measure the shear forces between the patient's trunk and the back of the wheelchair.

The displacement is measured by using a computer-controlled 35mm motion picture camera to record the position of markers on the body and on the chair. The film is then digitized to give the relative motion between the chair and the individual's body. Strain gauge instrumentation is applied to both the conventional reclining wheelchair mechanism and a modified reclining wheelchair mechanism where the axes of rotation were moved to coincide more closely with those of the body. Quadriplegic persons are seated in the chairs and positioned until they are satisfied that they are in a comfortable and normal position for them. They are evaluated similarly in either chair and without knee restraints commonly used to control motion. Shear force and displacement are then measured during descent from 80° to 5° from the horizontal and during ascent back to 80°.

FINDINGS TO DATE: Preliminary data suggests a significant difference between the conventional reclining chair and the new design with the axis of rotation moved into the plane of the body. The maximum range in shear was found to be on the order of 40 pounds in the conventional chair whereas it was approximately 20 pounds in the new design. Its placement varies significantly with the subject, but ranges of the same order of magnitude have been measured. Displacements of 5 to 10 cm. were measured in the conventional chair, while they were 2 to 4 cm. in the new design.

1. Attempting to align the axis of rotation of the chair with that of the body significantly decreases both the displacement of the body and the residual shear force.
2. The use of restraints with the conventional chair increases the trunk displacement and causes considerably higher residual shear forces.
3. The use of restraints with the modified chair eliminate residual displacement and further reduces the shear forces.

These findings indicate that further definition of the hip axis of rotation of the chair must be made and is being conducted at this time. A mechanism is being developed which will allow the axis of rotation to be adjusted for variations in length of body segments so that evaluation with patients can be conducted to determine the optimal location of this axis.

APPLICABILITY: Many patients cannot even consider the prospect of gainful employment at this time because of the barriers they see to continuous sitting. These limitations are primarily in the form of fatigue and imminent danger of skin breakdown due to the infrequent unweighting of weight bearing surfaces. Providing the quadriplegic patient with the ability to rest without need for special facility and or attendant would remove one of the major obstacles now facing these individuals in their quest for vigorous participation in social and vocational rehabilitation.

111 Control of Spasticity with EMG Biofeedback in the Incomplete Spinal Cord Injured Patient

Principal Investigator: **Jeffrey Steger, Ph.D.**
FY 1977
Status: **Continuing**
Dates: **April, 1975-April, 1978**
Cost: **Annual $6,715** **Projected Total $20,145**
RT Annual $6,715 **RT % of Annual Total 100%**
Annual Report Reference: **#15, Page 153, R-119**

OBJECTIVES: To determine the efficacy of surface electrode EMG feedback for decreasing spasticity in incomplete spinal cord lesions (where control may be possible).

METHODOLOGY: The effects of biofeedback will be determined by A. Monitoring surface EMG activity near the site of the spasm and providing visual or auditory feedback designed to enhance increased muscle relaxation in that area. B. Measuring spasticity (mean clonic frequency assessed in a standardized procedure—see methods) before and after feedback training to evaluate the extent of its change associated with decreased surface level EMG activity. C. Examining personality characteristics and mood before and after feedback training to determine the psychological impact of learning this self control procedure. D. Correlating changes in mood and personality characteristics with objective changes in EMG readings, spasticity change scores, subjective ratings of spasticity by the patient, and objective changes in range of motion, ADL capabilities, and activity levels.

FINDINGS TO DATE: The principal investigator has left this Center, and the project has been taken up by another member of the faculty with similar interests. The delay accounts for the absence of activity this grant period.

APPLICABILITY: This research may be of real benefit for spinal cord injured who suffer from the secondary disability of spasticity. Spasticity frequently interferes with transfer ability and ability to concentrate on work tasks therefore interrupting vocational and educational goals, and plans. Frequently, the only method available to control the frequent spasms in the legs is heavy medication which causes loss of alertness. A simple treatment technique such as this one, if effective, might be most helpful in helping spinal cord clients return to work.

112 Rehabilitation Indicators: A Method for Enhancing Accountability (This project, RSA funded, appears nominally within RT-1. Work on the project is centered in RT-1, RT-3, VA Hospital, Brecksville, Ohio, and University of Georgia.)

Principal Investigator: **Wilbert E. Fordyce, Ph.D.**
FY 1977
Status: **Continuing**
Dates: **October, 1974-October, 1979**
Cost: **Annual $5,405** **Projected Total$600,000 in RT**
$750,000 $150,000
in kind contribution
RT Annual $4,025 **RT % of Annual Total 74%**
Annual Report Reference: **#15, Page 258, R-125**

OBJECTIVES: To develop a set of multi-dimensional (ADL, Vocational, Social) rehabilitation indicators that will be applicable to a broad range of disabilities (physical, sensory, MR, psychiatric), and in many types of settings (VR, medical rehab, VA, sheltered workshops, etc.).

To enhance accounting for the multi-phasic nature of rehabilitation services by developing indicators that can be used at various points in time.

METHODOLOGY: To develop a set of multi-dimensional (ADL, Vocational, Social) rehabilitation indicators that will be applicable to a broad range of disabilities (physical, sensory, MR, psychiatric), and in many types of settings (VR, medical rehab, VA, sheltered workshops, etc.).

To enhance accounting for the multi-phasic nature of rehabilitation services by developing indicators that can be used at various points in time.

METHODOLOGY: Rehabilitation indicators will be developed by each of three factor relevant task forces (ADL, Vocational, Social) that meet the following criteria:

a. Items are to be behavioral descriptors, and
b. Relevant to goals of clients and rehabvilitation settings, and
c. Graded, scalable and potentially measurable, and
d. Potentially modifiable (behaviors have 'range'), and
e. Generalizable across sets of clients, not idiosyncratic.
f. The placement of each item must be defined within the hierarchy of the branching system.
g. The behavior described by the item must be consistent and reproducible.

Rehabilitation indicators may be used to develop client profiles, from which a weighting system may be derived. This proposed weighting system would assist in defining severity of disability functionally and also in helping to develop a weighted closure system.

The developmental phase of the Rehabilitation indicators project is in its final stages. Two indicator Sets, Social/Leisure and ADL-Mobility, have been completed. The former has been receiving extensive field testing within RT-3 during the past year. Two additional sets, Vocational, and Environmental Status Indicators, are nearing completion.

FINDINGS TO DATE: Preliminary results indicate the instrument has considerable sensitivity in picking up differences among groups (stroke vs. pain and patient vs. spouse) in regard to the frequency and duration of involvement in social/leisure activities.

Results of these studies are presently being analyzed and will be reported by or before next year.

APPLICABILITY: The product of this project will be responsive to the increasing demand for accountability, demand based within federal mandates, third party payers, consumer groups and individual clients.

The product will be relevant to providers of services in meeting the demand, in that present accounting systems are inadequate in justly describing input, process and outcomes of rehabilitation.

113 Effective Training in Rehabilitation Medicine in New Medical School Curricula*

***This project is being funded by a consortium of R&T Centers.**

Principal Investigator: **Frederick Kottke, M.D.**
FY 1977
Status: **New**
Dates: **October, 1974-September, 1976**
Cost: **Annual $13,800** **Projected Total $111,079**
RT Annual $13,800 **RT % of Annual Total 100%**
Annual Report Reference: **#15, Page 267, R-116**

OBJECTIVES:

1. To determine the extent to which exposure to rehabilitation medicine education experiences helps to develop in all medical students an understanding of the nature of chronic illness and its complications, and a working knowledge of the contribution which rehabilitation medicine offers to meet the multiple needs of the chronically ill. Specifically, the project will attempt to determine whether this exposure stimulates positive attitudes toward rehabilitation medicine, a working knowledge of rehabilitation medicine principles, and effective practice behavior in providing care for the chronically ill and severely physically disabled.
2. To identify newer types of prototypic rehabilitation medicine educational experiences which are effective and which are likely candidates for inclusion in today's medical school curricula.

METHODOLOGY: Through mail surveys of practicing physicians who have been exposed to (or, in the case of comparison subjects, who lacked exposure to) different types of PM&R education experiences at these schools, it will be possible to determine to at least some meaningful degree the important and long lasting attitudinal and behavioral effects stimulated by varying types and degrees of exposure to medical school PM&R educational experiences.

In essence, by using a retrospective research design which takes advantage of natural experimental situations and events which have occurred in four medical schools, these situations and events will make these schools and their curricula meaningful and representative targets for study.

FINDINGS TO DATE: This study is being conducted by social scientists in the Health Manpower Division of InterStudy, who for the past ten years have served as the research staff of the Commission on Rehabilitation Medicine.

Within the last year work has progressed on the project to the point that the mail survey has begun (June, 1976). The four medical sites where visited to reacquaint deans and department heads with the nature of the study. Current addresses and specialties of 1966 through 1972 graduates of the four medical schools are now being compiled with primary emphasis placed on surveying those physicians who have primary care or direct patient contact.

The survey questionnaire has been reviewed by Commission Board members and experts in medical education research. It is currently being revised for printing.

APPLICABILITY: This study has been designed to aid medical school policy makers by answering meaningful questions about relevant types and combinations of rehabilitation medicine experiences which they might realistically consider for inclusion in medical school curricula. The installation of more effective RM educational experiences could eventually lead to a greater proportion of the nation's severely disabled and chronically ill receiving more effective rehabilitation services.

114 Incorporation of a Lexan "Check Socket" into a Definitive Patellar Tendon Bearing Prosthesis

Principal Investigator: **C. G. Warren, M.P.A.**
FY 1977
Status: **New**
Dates: **October, 1975-October, 1977**
Cost: **Annual $12,468** **Projected Total –**
RT Annual $10,465 **RT % of Annual Total 84%**
Annual Report Reference: **#15, Page 108, R-122**

OBJECTIVES: The objectives of this study are to establish a method of incorporating a lexan check socket into a structural mechanism which is lightweight, adjustable, and upon which the subject can ambulate for periods of time significant enough to evaluate the fitting of the socket, anywhere from 3 days to 3 weeks. In the long range, it is possible that if the lexan proves to be suitable as a long term definitive socket material that this methodology could be expanded to incorporate the lexan socket into the definitive prosthesis.

METHODOLOGY: The method of mounting the lexan socket utilizes an inverted fiberglass cone or funnel into which the lexan socket is placed and mechanically interlocked by the strapping method. It can be further stabilized, if necessary, by foam support in the lexan socket within the cones. The cone is attached to a wooden block which carries the conventional bolting assembly to the alignment devices, pylon and foot. The socket can be retrieved from the fiberglass cone by unstrapping it.

Having completed the suitable method of attaching the lexan socket to the remainder of the limb the question yet remained whether or not the structural integrity of the unit could be maintained under walking conditions.

FINDINGS TO DATE: With the results of this evaluation it is evident that the prosthesis can sustain the static loads and it is safe for limited ambulation by the patient. We have not as yet formally established the fatigue characteristics of the coupling (i.e. how it will perform under dynamic loading). However, further evaluation of the data obtained in the static test analysis will allow us to determine the importance of conducting cyclic loading at load rates incurred in normal ambulation. The static data will allow some prediction of the likelihood of breakdown under dynamic stress.

APPLICABILITY: The prosthetists who use this Lexan check socket at the present time cannot have the patient walk on the socket and must add several additional visits to their schedule during the primary fitting. For these reasons many do not use the technique.

If this socket could be incorporated into a prosthesis for a period sufficient for evaluation, many more prosthetic facilities would begin to use the Lexan sockets. Their use could reduce the frequency of ill-fitting prostheses and complications due to skin trauma produced by ill-fitting prosthesis.

In addition, the total cost of producing a prosthesis may be reduced and subsequent and repeated alterations may be reduced or eliminated.

115 Functional Distinction Between Neural Systems Involved in the Disabilities of Parkinson's Disease

Principal Investigator: **Marjorie E. Anderson, Ph.D.**
FY 1977
Status: **New**
Dates: **October, 1976-September, 1978**
Cost: **Annual –** **Projected Total –**
RT Annual – **RT % of Annual Total –**
Annual Report Reference: **#16, R-127**

OBJECTIVES: To determine the tonic firing pattern of antidromically-identified nigro-striatal and nigrothalamic neurons during active postural stabilitation in awake monkeys. The hypothesis is that nigrothalamic neurons will show a regular tonic firing pattern in this paradigm and that nigrostriatal neurons will show a pattern that is sufficiently distinct such that they can be identified on the basis of this pattern.

METHODOLOGY: Juvenile monkeys (M.mulatta or M.fascicularis) will be trained to maintain a stable head position, in which a light beam from an overhead source is reflected by a skull-mounted dental mirror into an overhead photo-detector cell. Maintenance of this position for the required number of seconds results in delivery of an applesauce reward from a tube mounted in front of the animal, and colored signal lights and presence or absence of a tone indicate "on" vs. "off" position to the animal. The animal's food intake outside the training time is reduced during initial training, but he is not allowed to go below 80% initial body weight at any time, and after initial training, is fed enough to insure a normal growth rate for these immature animals.

At a later time, using a technique adopted by others (D. Bowden, E. Fetz) at the Regional Primate Center and satisfactorily tried by us in one preliminary monkey, stimulating electrodes can be positioned in an awake, behaving animal during recording from the structure under study. This kind of arrangement will be used to allow optimum positioning of electrodes for antidromic excitation of thalamic-projecting nigral neurons from VAmc and VLm, and of nigrostriatal fibers, as they course dorsolaterally in the vicinity of the sub-thalamic nucleus and along the medical border of the internal globus pallidus.

The activity of single neurons in the substantia nigra will be recorded with electrolytically-sharpened tungsten electrodes, insulated except at the tips, which are covered with electrolytically deposited iron particles to improve recording characteristics. The recording electrode is back-fed into a sterile hypodermic cannula, which is inserted through a calibrated R-O adapter, penetrates the silastic and dura, and extends to a position approximately 5-8mm. above the substantia nigra. The electrode is advanced through the cannula with a hydraulic micromanipulator, and the tonic activity of all isolatable units expected to be in the vicinity of the substantia nigra is recorded. Following acquisition of data during 1-2 minutes of stable, on-target behavior, a unit will be tested for antidromic activation from each of the stimulating electrodes described above. Criteria for antidromic activation will be:

(1) ability to respond faithfully to each stimulus in a train of 5 stimuli delivered at 500/sec.

(2) constant latency, using just supra-threshold stimulus intensities, and

(3) collision with "spontaneous" action potentials, such that failures will occur if the time between the "spontaneous" potential and the stimulus is less than the evoked potential latency plus the refractory period. Threshold stimulus intensities will be determined for each electrode and used to assess the probability of stimulus spread to the other (nigrothalamic or nigrostriatal) system.

Amplified neuronal activity, the output of a stimulus intensity monitor, and logic pulses indicating feeder delivery and "on" vs. "off" head position will be recorded on tape with an Ampex 1800 L analog record. Small electrolytic lesions and deposits of the plated iron particles will be made at known electrode tip depths relative to the top of the microdrive adapter in several tracks, to allow later reconstruction of recording positions for all neurons.

Following experimental procedures, animals will be anesthetized deeply with sodium pentobarbital and perfused with saline and formalin. The brain will be removed and fixed, frozen sections will be cut and stained with cresyl violet and with potassium ferrocyanide to elicit the Prussian blue reaction with the deposited iron particles. Recording positions will be reconstructed by reference to identified lesion-iron marks made at known positions and mapped on a standardized set of sections.

Firing patterns of neurons will be described in terms of interspike interval analysis done off-line with taped data using existing programs for the Honeywell DDP 516 computer.

This study will require 2-4 monkeys, depending on whether or not data can be collected bilaterally.

FINDINGS TO DATE: This project was initiated on the basis of preliminary data gathered on two monkeys and presented at the Neuroscience meetings. In addition to completing the analysis of those data, during the five months we have trained another monkey and surgically implanted the chamber and stimulating platform, so that he is now ready for recording.

To summarize our preliminary data to date, we have found neurons in the substantia nigra that exhibit two basic types of firing patterns when the animal actively maintains a stable head position. All of those clearly located in the pars reticulata region of the substantia nigra (N=21) had regular, high frequency discharge patterns, similar to those reported previously for globus pallidus neurons. The pars compacta region of the substantia nigra, which is smaller and interdigitates with pars reticulata, contains cells of nigrostriatal system and included some neurons with this high frequency, tonic discharge, as well as others with a slow frequency burst pattern. In the initial animals we did not have an adequate set-up to stimulate these cells antidromically, but the data to date would indicate that the nigrothalamic cells probably do have the tonic high frequency pattern and that the pattern for the nigrostriatal neurons may or may not be of the burst type. The monkey now ready for recording has the platform array described for inserting stimulating electrodes and should allow us to identify the projections of the neurons by exciting them antidromically.

APPLICABILITY: Parkinsonian patients would benefit from therapy based on an improved understanding of how the basal ganglia operate in assuring appropriate motor control.

116 Modification of Speech Patterns of Normal and Dysarthric Speakers as a Function of Four Rate Control Strategies

Principal Investigator:	**David R. Beukelman, Ph.D.**	
FY 1977		
Status:	**New**	
Dates:		
Cost:	**Annual —** **RT Annual —**	**Projected Total —** **RT % of Annual Total —**
Annual Report Reference:	**#16, R-128**	

OBJECTIVES: The objectives of this study are to determine the durational, intonational, and stress pattern changes of normal and dysarthric speakers, who are instructed to control their speaking rate through four strategies (1) external pace stimulus provided by the experimenter (2) concurrent external pace stimulus provided by the speaker (3) momentary pause between each word and (4) completion of an utterance within an allotted time. The relationship between speech intelligibility of dysarthric speakers and rate control strategies will be studied.

METHODOLOGY:

1. Normal adult speakers and dysarthric speakers, who speak with less than normal intelligibility, will be included in this study. Ten normal speakers will be included in the first phase of the study, and twenty dysarthric speakers in the categories of ataxic dysarthria and hypokinetic dysarthria will be included in the second phase of the study.
2. During the first phase of the study each speaker will be audio recorded as he produces four sample sentences under one control and four experimental conditions. During the control recording session the speakers will be instructed to read sentences in their habitual conversational manner. The criterion rates under each experimental task will be 60 words per minute, 100 words per minute, and 140 words per minute. During each of the experimental recording sessions, the speakers will be instructed to control their rate according to one of the specific rate control strategies listed under the objective section of this proposal. (1) **External pace stimulus** (2) **Concurrent external pace stimulus provided by the experimenter** (3) **Momentary Pause** (4) **Time Allotment.** Speakers will be permitted to practice various speaking rates with material other than the target material of the study. When they are speaking at criterion rates, the target sentences will be presented and recorded. Each of the four experimental recording sessions will occur on a different day, so that the learning effects on the speaking performance of the subjects will be reduced. The order of the speaking rates under each experimental conditions will be randomly selected.

   Speech samples will be selected such that each potentially will include a unique stress or intonation pattern. Stress and intonation patterns planned are (1) primary stress first word of sentence (2) primary stress last word of sentence (3) sharp raising intonation last word of sentence and (4) gradual rising intonational pattern throughout the sentence.

   All speech samples will be recorded on an audio tape recorder, with the microphone placed 10" anterior to the lips of each speaker. The primary acoustic analysis will be completed by an experimental program on a PDP 11 computer. This program simultaneously analyzes fundamental frequency (pitch), intensity (loudness), and the durational aspects of speech and silence during an utterance. From these data that following observations will be taken. (1) Speaking rate, (2) percentage of total utterance time given to pauses, (3) percentage of total utterance time given to articulation, (4) description of the fundamental frequency (intonation) contour and (5) description of the loudness contour.
3. Phase two of the study which includes dysarthric speakers from the ataxia and the hypokinetic groups will be very similar to phase 1 with the following exceptions: (1) the rate conditions (60, 100, 140 words per minute) may not be required of all patients. An attempt will be made to have the dysarthric person speak at as many of these rates as is possible. Also, they will be asked to speak at approximately 60 and 40 percent of their conversational rate. Also (2) the speech intelligibility of each dysarthric speaker for each sentence recorded will be judged on the 7 point scale. The tapes will be rated by three judges.
4. The entire tapes of two normal speakers, two ataxic and two hypokinetic dysarthric speakers will be acoustically analyzed a second time for reliability purposes. The tapes of two ataxic and two hypokinetic dysarthric speakers will be rated for intelligibility a second time for reliability purposes.

FINDINGS TO DATE: The life of this project is currently approximately 2½ months. Progress to date includes (1) development of relationships which allow for access to acoustic analysis system (2) modification of the system to accept and analyze acoustic segments to 4.7 seconds in length (3) agreement to contract for computer time (4) development of stimulus material (5) analysis of pilot data from two normal subjects completed.

APPLICABILITY: The treatment plan of most dysarthric patients include a modification of speech rate, although many authors recommend that the speech rate of certain dysarthric speakers be reduced, and some authors suggest strategies to achieve this purpose. Information about the effectiveness of this strategy has not been determined. The information gathered in this study will be used extensively to select treatment strategies designed to modify the speaking rate of dysarthric speakers.

117 Rehabilitation Needs of Cancer Patients

Principal Investigator:	**Justus F. Lehmann, M.D.**	
FY 1977		
Status:	**New**	
Dates:	**Sept., 1976-September, 1977**	
Cost:	**Annual**	**Projected Total**
	RT Annual	**RT % of Annual Total**
Annual Report Reference:	**#16, R-129**	

OBJECTIVES: The objectives of this study are to screen the cancer population in order to determine type and frequency of rehabilitation problems occurring in this population and thus to produce a quantitative estimate of the need for various rehabilitation services. Special effort will be made to identify gaps between a recommended rehabilitation program and that actually received. When such gaps in the health care delivery system are identified, an effort will be made to identify the barriers or obstacles which prevent the patient from receiving the optimal rehabilitation care. Identification of barriers would lead to recommendation of remedial action and finally a test of the effectiveness of the recommended approach toward ultimate resolution of the problem.

METHODOLOGY: The cancer population consisted of patients referred to four participating hospitals. A randomly selected sample of 805 cancer patients was screened by physicians in their third year of residency training in physical medicine and rehabilitation supervised by faculty members. The patient's hospital chart was reviewed, and after informed consent, an interview with the patient and his family was conducted, followed by an examination of the patient. A detailed protocol for interview and examination was developed by the rehabilitation team.

Rehabilitation problems were identified by the organ system involved — skeletal, vascular, respiratory, neuromuscular, skin and head and neck. Within each system, specific problems were isolated — such as amputation site, joints with contractures or the specific nerves involved. Problems were also viewed from a functional perspective such as impaired communication, impaired respiratory function, pain problems, cosmesis, restricted activities of daily living, ambulation, mobility and transfers. As each problem was identified, details of the impaired function were elicited.

In addition, housing, transportation and vocational adaptation were reviewed. Special attention was given psychological adaptation to cancer disability. Patients were placed in diagnostic categories by means of a structured interview. These characteristics were noted: depression, dependency and/or inactivity markedly in excess of physical limits, pain behavior markedly in excess of physician expectation, non-compliance with medical treatment regime, marital and/or sexual dysfunction, social isolation, body image concerns, intellectual deficits and behavior changes due to organic brain syndromes. In children the categories included delayed psychological development: altered educational progress with lowered academic achievement; increased parent-child, sibling-patient conflict, and maladjusted behavior on the part of the sibling.

A program of intervention judged optimal was then recommended for each patient and compared with actual rehabilitation services received. A difference between recommendation and treatment received was defined as a gap in service delivery. When a gap was found, an attempt was made to identify the reason(s) for it. A standardized list of possible barriers developed in a pilot study was used for this purpose, but a screener could add barriers not on the list.

Based on the analysis of the sample, a rehabilitation care delivery model will be established. The Patient Care Coordinator supporting the Clinical Oncology Team will be instrumental in expediting the patient flow from service to service.

The Clinical Oncology Team will be connected to the Comprehensive Rehabilitation Team (Physiatrist, psychologist, physical therapist, occupational therapist, social workers, speech pathologist, vocational counselor, rehabilitation nurse and prosthetist-orthotist) through the link of the physiatrist. A program for in-service training of both teams will present rehabilitation concepts to the oncology team and advances in cancer care to the rehabilitation team.

Individual patient care by the Comprehensive Rehabilitation Team will be implemented via a special consultation process. As a part of this process, all cancer patients treated by the oncology team will be screened for potential rehabilitation problems by a Rehabilitation Coördinator.

The next phase of this project is to implement the model and measure its effectiveness. The initial screen will be repeated on another random sample and the results compared.

FINDINGS TO DATE: The frequency distribution of the cancer sites within the sample was shown. The sites were regrouped in order to allow a comparison with a national sample. From these results it is apparent that the site frequencies from the participating hospitals, all of which are referral centers, were not always identical with those in the general population. Cancer of the digestive organs is most often dealt with in the community hospitals; referrals to the participating institutions are made in only a small number of cases. In contrast, referrals of leukemia and lymphoma cases are twice as frequent as could be expected from the incidence of these cancer sites in the general population. This finding can be readily explained by the specialized program which the participating hospitals offer in the treatment of these cancer sites. Such results suggest that the findings of this survey should be generalized only in qualitative, not quantitative fashion.

An assessment of the problems in the cancer population screened show that problems relate both to system involvement and to loss of function. In general terms, the screen confirms the need for rehabilitation care in a cancer population. The data shown also indicate that a significant portion of the problems can be improved by the techniques available in rehabilitation, since these are problems frequently met in other types of disability such as stroke and spinal cord injury.

Because psychologic problems were a common occurrence in the screened population, this category was further examined. When the sample with psychologic problems was broken down according to the site of the cancer, it was found that these problems were common in virtually all cancer sites, perhaps somewhat more common in cancer affecting the nervous system. Of all people with nervous system cancers, 78% had one or more psychologic problems.

In order to assess the impact of associated physical disabilities on the prevalence of psychological problems, the total sample screened was divided into a group of patients without physical medicine problems and a group with physical medicine problems. The following list was used to define these problems: paralysis, paresis, intellectual/perceptual and memory deficits, communication impairment, contractures, pressure sores, impairment of ambulation, transfers and self-care, fractures, amputations and lymphedema. Generalized weakness was not included in the list as a specific physical medicine problem. The number of patients with one or more psychological problems in each group was compared. The results show that the incidence of psychological problems is greater when cancer is associated with a physical disability. Physical medicine problems as defined above are found at a uniformly high frequency across the various sites. The exact frequency will largely depend on the breakdown of each problem area. The more detailed the breakdown the greater the likelihood that a subject in a statistical sample will have one or more of these problems.

The rehabilitation problems involving systems and representing functional loss were broken down according to cancer site. These findings suggest that the frequency of various rehabilitation problems, classified by system or by functional loss, can be anticipated by the course of the cancer and its intervention.

The breakdown of functional rehabilitation problems according to cancer site shows a high frequency of activities of daily living problems in breast cancer, cancer of the respiratory system and of the nervous system (explained by contractures). Shortness of breath, paralysis and paresis respectively. Transfer problems are more often encountered in cancer of the respiratory system because of loss of respiratory reserves and often associated obstructive pulmonary disease due to smoking. In the case of the nervous system cancer, this difficulty is due to paralysis, paresis or intellectual/perceptual deficit. Ambulation problems occur frequently in cancer of the respiratory system and the nervous system for the same reasons. The somewhat elevated incidence of ambulation problems in breast cancer in this sample is due to common bony metastases. Communication problems are encountered frequently in head and neck cancer since laryngectomy is a common intervention. Nervous system cancers frequently produce aphasia, dysarthrias, apraxias and other speech and language problems. It is difficult to explain the higher frequency of family support problems in the case of breast cancers, cancers of the nervous system and bone. The most likely common denominator is an actual or perceived rejection by the spouse or other family members since these cancers produce visible deformities. One also should recognize that most bone cancers occur in children, where sibling and parental relationships are important. Vocational problems are also frequently encountered because of physical disability in nervous system cancers and the limited respiratory reserve in cancers of the respiratory system. In leukemia, vocational problems frequently include changes required in academic or technical training programs since the incidence is higher in the younger age groups. Other difficulties, such as psychological problems, general weakness and pain seem to be common in cancer of all sites.

Results of the initial screen did demonstrate gaps in rehabilitation care delivery. Next an effort was made to identify why the gap in the rehabilitation service delivery existed. A likely explanation seems to be that many of the physicians presently in practice had not been exposed to rehabilitation medicine in their medical school curricula. As a result, the primary physicians to the cancer patients seem unable to identify rehabilitation problems in their patients and to make appropriate referrals for rehabilitation services. Even if they identified a problem, they were often unfamiliar with what rehabilitation might have to offer their patients.

Surprisingly, lack of financial resources did not appear as a major barrier even though this type of barrier is common in disabilities not related to cancer. However, since the lack of referral to rehabilitation services by the primary physician represented by the primary physician represented such a major barrier, it was possible that other barriers, such as limitation of financial support for rehabilitation care, might have been obscured. Therefore a more detailed analysis of the financial support structure for the cancer patient was made to show source of principal support for health care of the patients sampled. Data suggest that at present the financial support structure for both health care and maintenance does not represent the major barrier to rehabilitation care.

APPLICABILITY: The findings will be primarily utilized to alter the health care delivery system so that the appropriate services are available for the appropriate cancer sites and the results will be used as a quantitative basis for planning of such a model delivery system.

118 Respiratory Function of Quadriplegic Individuals: Influenced by Glossopharyngeal Breathing Training and Periodic Long Term Follow Up*

Principal Investigator:	**Rosemarion Berni, R.N., M.N. and David R. Beukelman, Ph.D.**	
FY 1977		
Status:	**New**	
Dates:	**December, 1976-December, 1977**	
Cost:	**Annual—** **RT Annual—**	**Projected Total—** **RT % of Annual Total—**
Annual Report Reference:	**#16, R-130**	

*For the purpose of closer coordination two approved projects have been combined, namely: Influence of Lesion Level, Time of Onset, and Glossopharyngeal Breathing Treatment on Vital Capacity Measurement of Quadriplegic Patients and Periodic Evaluation of the Respiratory Function of Discharged Quadriplegic Patients.

OBJECTIVES:

1. To compare assisted (with GPB) and unassisted vital capacity measurements generated by quadriplegic patient spinal cord injuries at C4-5, C5-6 and C6-7 respectively.
2. To compare change in unassisted vital capacity measurements which occur as one group of quadriplegic patients receives GPB treatment and another group of quadriplegic patients receives no treatment.
3. To compare assisted and unassisted vital capacity measures taken during long-term follow-up.
4. To describe personal respiratory maintenance program after discharge.

METHODOLOGY: All subjects included in this study will be classified as quadriplegic due to functionally complete cervical cord lesions. No subject with known respiratory impairment other than related to quadriplegia will be included. 20 subjects will be included in Group 1 – GPB treatment and 20 subjects will be included in Group 2 – non-GPB treatment[1] will be matched according to a) sex b) time since onset c) age and d) height.

GPB treatment will be delivered once daily for 20 minutes to subjects included in Group 1. Assisted vital capacity measurements and unassisted vital capacity measurements (the maximum measurement during 3 trials) will be taken once weekly from the patients in the treatment group. Unassisted vital capacity measurements will be taken once weekly from the control group. All measurements will be taken in the supine position, since data collection will begin before some of the subjects are able to sit. Glossopharyngeal breathing treatment will be terminated for subjects in the treatment group when the assisted vital capacity measurement does not improve more than 50 cc during a 2 week time period. Data will be collected from each control subject during a time interval equal to that spent by his matched treatment subject in the glossopharyngeal breathing treatment program.

Following discharge from the Rehabilitation program assisted and unassisted vital capacity measurements will be taken at 3 month intervals. At each interval, the quadriplegic person will be asked to answer a questionnaire designed to explore his respiratory maintenance program. The follow-up data will be taken by a registered nurse, who will be trained by the primary treatment staff to reliably measure (.95) assisted and unassisted vital capacity.

Those patients in the study population who continue the respiration maintenance program and those who fail to continue the program will be followed after discharge from the hospital.

The rehabilitation nurse will obtain respiratory measurements with the subjects in recumbent and sitting positions. The best effort the patient obtains in any testing series is the value used for vital capacity.

The mean of ten consecutive tidal breaths will be utilized for the measurement of tidal volume.

During the review of this project when it was initially proposed, the question was raised why a speech pathologist was involved in this study. At University of Washington Hospital glossopharyngeal breathing techniques are taught to quadriplegic patients by the speech pathology staff.

[1] Quadriplegic patients included in the control group will receive GPB treatment prior to their release from the hospital, however, the initiation of their study will be delayed until data is collected for the present study.

FINDINGS TO DATE: The life of this project is currently approximately 3½ months. Three quadriplegic persons have completed the glossopharyngeal breathing treatment program and the inpatient data have been completely collected from these subjects.

The results of the three persons who completed the GPB program are presented below:

Lesion Level	Pre-Training Unassisted Vital Capacity	Post-Training Unassisted Vital Capacity	Post Training Assisted Vital Capacity
C_4-C_5	1350 cc	3200 cc	3340 cc
C_5-C_6	2520 cc	3750 cc	3950 cc
C_6-C_7	2480 cc	3200 cc	4200 cc

Two additional quadriplegic patients are currently involved in the treatment program. No data has been collected from the control subjects. The equipment to be used in the follow-up phase is on order and the questionnaire is being prepared.

APPLICABILITY: The results of this study will assist members of the rehabilitation team as they seek and select training procedures designated to increase respiratory capacity of quadriplegic patients with various time of onset and various lesion levels.

Expected consumers' use of findings:

a. Better respiratory maintenance.
b. Better overall body system function.
c. Better potential for employment.
d. Better opportunity to prevent physiological and psychological deterioration and increased cost to the consumer or the taxpayer.

119 Measurement of Musculature Blood Flow Induced by Microwave Diathermy

Principal Investigator: **Justus F. Lehmann, M.D.**

FY 1977
Status: **New**
Dates: **August, 1976-August, 1977**
Cost: **Annual** **Projected Total**
RT Annual **RT % of Annual Total**
Annual Report Reference: **#16, R-131**

OBJECTIVES: To ascertain the quantitative relationship between doses of microwave diathermy and deep musculature blood flow increase and rate change.

METHODOLOGY: A radio labeled isotope I^{125} will be injected into deep musculature before a microwave diathermy application. The disappearance rate of this isotope will be monitored by a scintillation counter before and after heating by microwave [2,3]. The slopes of these curves can be used to determine the amount of blood flow.

By comparing resting levels of blood flow and the increase in blood caused by the microwave heating, one can calculate the rate of change in blood flow due to the temperature increase. These values can then be related to the amount of power required to cause the increase and also the rate at which this energy was delivered to the tissue.

I. **Experimental Procedures**

A. **Preliminary Sessions:**

In a preliminary session the subject will be familiarized with the general procedures to be followed during the measurement session. One or two X-Rays of the front part of the thigh will be taken at this time. The purpose of the X-Rays is to determine the position of certain structures (muscle-fat boundary, femur) which will underlie the diathermy applicator. Areas which are particularly sensitive to X-Rays (gonads) will be protected by a lead apron at the time of the X-Ray. This session will last for 20 minutes.

B. **Experiment Session:**

At this session the rest period is preceded by an injection of 0.05 ml (one drop) of radioisotopically labeled iodine — antipyrine compound into a forearm (or thigh muscle) through an extremely fine (1/100 inch thick 27 gauge) needle which usually cannot be felt. Since we allow only one injection per individual we divide this experiment into two parts.

Some subjects will do Part I and some Part II. The subjects will be told which part they will be participating in during the preliminary session.

Part I: Injection of isotope will be in a resting forearm or thigh. **This arm or leg must be held still for the entire 30 minutes of treatment** to maintain proper alignment of focus with the scintillating counter.

Part II: Injection of the isotope will be made into a forearm or thigh muscle over which is strapped a small, light weight isotope counting probe. Also 4-5 small needles containing temperature measuring devices will be inserted into the front part of the forearm or thigh. These will be used to make continuous temperature recordings from the tissue underlying the diathermy applicator. Before the insertion of the needles, the forearm or thigh will be washed with an anti-bacterial soap.

One more X-Ray will be taken at this point to check on the needle placement. After a 5 to 10 minute rest period to allow for temperature stabilization, the diathermy treatment will begin. The diathermy will be applied for 20 to 30 minutes, or less, if the subject starts experiencing pain. After the diathermy is stopped, temperature recording will continue for another 20 minutes. The total time commitment involved in this experiment will be 2 hours.

II. **Instrumentation and Materials Used to Carry out the Experiments:**

A. Thermistors built into 20 gauge teflon catheter needles will be used to measure the temperature of the thigh[3].

B. A 915 MHz general electric magnetherm which has been adapted to give complete control of the power levels generated will be used to produce the energy. A 915 MHz air cooled contact applicator that has been designed and tested in our laboratory will be used to transmit the energy from the generator to the tissue[4].

C. A scintillating crystal counter will be used to count the energy emitted from the iodine radioisotope as it leaves the initial deposit.

D. Radioisotope: I^{125} antipyrine is a very weak-emitting, low energy radioisotope of iodine which has been safely and routinely used for blood volume and flow measurements in man for many years. It will be injected once into a quadriceps or forearm muscle through a very thin needle (0.3 – 0.35 mm or 1/100 inch) which can barely be felt going 1-2 cm (or ½ to ¾ inch) into muscle. It is too small to cause significant bleeding.

The half-life of this isotope in the body is 12 days (½ disappears). Because the iodine released from the antipyrine will accumulate in the thyroid gland, the Radiation Safety committee has limited the dose to 5 microcuries. (Much greater doses have been used routinely for many years.) Five microcuries merely indicates that the dose is extremely small – and very far below the smallest amount which might constitute a potential risk.

FINDINGS TO DATE: All the instrumentation that was described in the previous paragraph has been brought together and the room for using radioactive materials has been set up. We will start running volunteers in May or June, 1977.

APPLICABILITY: The information that will be obtained can be used by engineers to design improved applicators, to test their designs and also by physiatrist and physical therapist to prescribe and carry out more effective diathermy treatments.

120 Mapping of Microwave Fields Surrounding Human Subjects Under Diathermy Treatment

Principal Investigator:	**Justus F. Lehmann, M.D.**	
FY 1977		
Status:	**New**	
Dates:	**August, 1976-August, 1977**	
Cost:	**Annual** **RT Annual**	**Projected Total** **RT % of Annual Total**
Annual Report Reference:	**#16, R-132**	

OBJECTIVES: The objective of the study will be to measure and plot contours of equal field intensity around human subjects while they are being irradiated with electromagnetic energy by microwave diathermy equipment operating at 915 and 2450 MHz.

METHODOLOGY:

1. All measurements will be carried out in an anechoic chamber, so precise field intensity levels around the subject can be obtained. Human volunteers will participate in this study. They will be placed in the anechoic chamber in a position which is typical of diathermy treatments. The position of the subject will depend on the area to be treated. Selected areas of the body that are frequently treated with diathermy will be used – tight joints, anterior and posterior shoulder, contractor of the biceps, the lower back and contractors of the thighs. The selected area will be treated with microwave applicator operating at 915 and 2450 MHz.
2. An X-Y-Z co-ordinate tracking system with a National Bureau of Standards energy density probe attached will be shielded and placed in the anechoic chamber. This device will be computer-controlled to follow isobars of power densities with limit switches to set the area that is to be scanned. The computer will position the probe and also plot the field intensity levels in relation to distance from the diathermy applicator. This facility will allow us to make many measurements in a short period, which reduces the time of microwave exposure.
3. Instrumentation will include the following:

   a. National Bureau of Standards power meter: measures the power density in an electromagnetic field. Frequency of 10 MHz-3000 MHz accurate to 1.0 DB.

   b. X-Y-Z tracking system. This is a commercially available system that was purchased and modified to be controlled by our Honeywell Computer.

   The N.B.S. probe is attached to this system so it can be moved in any of three coordinates. A zero point is set by the operator and this is placed in the computer. A grid is then set up and the computer directs the tracking system to move in the increments defined, 1 cm-2 cm, etc. The computer then moves the probe throughout this grid while recording the power density measurements at each point.

c. Thermistor power meters will be used to monitor the incident and reflected power going to the applicator.

d. Microwave generators operating at 915 and 2450 MHz will be used to supply power to the antennas.

e. The contour lines of power density will be plotted on standard X-Y recorder.

FINDINGS TO DATE:

1. The anechoic chamber was tested by setting up a ground plane with a monpole antenna at one end of the room. The field intensity that the monopole antenna would theoretically produce was calculated. The X-Y-Z tracking system was then used to move the National Bureau of Standards power meter around the room to determine the actual power levels. These values were then checked with the theoretical curves to see if there were any standing waves produced in the room, due to either reflections from the walls, floor and ceiling of the shield room or from the X-Y-Z tracking system. The curves were within DB which is within permissible limits. Phantom models electrically equivalent to human tissue were then tested in the room to insure that the tracking system functioned and that the computer could take the data properly[4]. All systems worked well.
2. Next two human subjects were tested to see if they could remain still long enough to make the measurements. The subjects were able to remain motionless long enough to make the power density measurements. Measurements were made around the subjects when the applicator was placed over the trapezius muscle and also over the anterior rectus femorus. Power density measurements were made around the eyes when the shoulder was irradiated and it was below the 5 mw/cm^2 proposed standard level. The area around the gonads was also measured and it was below the 5 mw/cm^2. This preliminary data was gathered to help the Bureau of Radiological Health propose medical standards.
3. Formal measurements on human subjects will begin in May, 1977.

APPLICABILITY: Findings will be utilized by standard-setting agencies for medical devices, especially microwave diathermy equipment. Findings would also ultimately be used by practitioners.

baylor college of medicine

RT4

texas institute for rehabilitation & research

Baylor College of Medicine (RT-4) Medical Rehabilitation Research and Training Center

CORE AREAS

The Comprehensive Rehabilitation of Persons with Severe Spinal Cord Injury

Describing and analyzing the mechanisms of the functional limitations and disability that are involved, devising new and more effective treatment procedures, evaluating systematically the outcomes of specific rehabilitation services, developing improved services that will enable persons with severe functional limitations to live productively in the community.

Rehabilitation of Patients with Ischemic Heart Disease

Evaluating the effects of reconditioning exercise for these persons and determining the physical and biochemical bases of these effects.

Behavioral Ecological Studies of the Comprehensive Rehabilitation Process

To assess a patient's progress both inside and outside of the hospital and to evaluate the effectiveness of specific rehabilitation programs.

Rehabilitation-Related Applications of Biostereometric Methodology

Rehabilitation-related applications of biostereometric methodology to providing precise quantitation of the three-dimensional geometry of body deformities and limitations of motor functioning.

BAYLOR UNIVERSITY

William A. Spencer, M.D., Director
Baylor University Medical
Rehabilitation Research and Training Center
1333 Moursund Avenue
Houston, Texas 77025

PROJECT TITLES BY FY 1977 STATUS

COMPLETED

	Abstract No.
Collection and Analysis of Clinical Data on Scoliotic Patients (P. R. Harrington, M.D.)	121
A Work Tolerance Evaluation Research and Training Unit for a Cardiac Rehabilitation Program (D. Cardus, M.D.)	122
An Investigation of the Cause of Abnormal Electrolyte Distribution and Excretion in Men with Complete Section of the Spinal Cord (J. Claus-Walker, Ph.D.)	123
Research Developments of Lower Extremity Orthotic Systems for Patients with Various Functional Deficits (T. J. Engen, C.O.)	124
Electrophrenic Nerve Stimulation — A Feasibility Study (R. E. Carter, M.D.)	125
Psychological Consequences of a Change in Lower Extremity Orthotics (Shalom Vineberg, Ph.D.)	126
Enterobacterial Vaccine as a Means of Controlling Infections in Spinal Cord Injured Patients (R. E. Carter, M.D.)	127
The Use of an Intraurethral Catheter to Provide Urinary Drainage (Roger S. Munro, M.D.)	128
A Cybernetic Study to Control Spinal Reflex Activity in Spinal Cord Injured Patients (J. Canzoneri, III, D.Sc.)	129
Externally Controlled Modification of the Impaired Ambulation of Hemiparetic Patients by Use of Multisite Percutaneous Stimulation (W. A. Spencer, M.D.)	130
Attempted Dissolution of Struvite ($MgNH_4PO_4 \cdot 6H_2O$) Urinary Calculi(D. P. Griffith, M.D.)	131
A Longitudinal Study of Depressive Reactions in Persons with Spinal Cord Injuries (E. P. Willems, Ph.D.)	132
A Longitudinal Study of Quadriplegic Young Adults in a Cooperative Self-Support Residential System (J. Cole, Ph.D.)	133
A Study of Residential Environments for Physically Disabled Young Adults in Houston, Texas (J. Cole, Ph.D.)	134

Use of Acetohydroxamic Acid (AHA) in Humans (D. P. Griffith, M.D.) 135

CONTINUING

Comparison of Two Dosage Schedules of Gold in the Treatment of Rheumatoid Arthritis (J. T. Sharp, M.D.) 136

Exercise and Lipid Profile in Ischemic Heart Disease (D. Cardus, M.D.) 137

Clinical Studies of Calcium in Quadriplegia: Collagen Metabolites and Bone Related Complications (J. Claus-Walker, Ph.D.) 138

Longitudinal Analysis of Patient Behavior (E. P. Willems, Ph.D.) 139

Evaluation of the Potential Therapeutic Effects of Applying Electrical Stimulation to the Affected Wrist and Finger Extensors and Flexors in Patients with Upper Motor Neuron Lesions (R. Campos, M.D.) 140

Development of an Optimal Discriminant Function for the Early Detection of Scoliosis (R. E. Herron, Ph.D.) 141

A Study of Factors Related to Personal Independence Gains of Spinal Cord Injured Patients During Initial Rehabilitation Care (Susan Baker, M.F.A.) 142

Analysis of Information Processing Training for the Severely Disabled (M. Sanderson, B.S.) 143

NEW

Treatment of the Neurogenic Dysfunctional Bladder by Implantable Artifical Sphincter (D. P. Griffith, M.D.) 144

Retention of Habituation of Reflex Activity Mediated by the Transected Human Spinal Cord (M. J. Fuhrer, Ph.D.) 145

Immediate Stabilization of the Fractured Thoracic and Lumbar Spine with and without Neorologic Deficit (J. H. Dickson, M.D.) 146

Appropriate Entry Level Jobs and Sheltered Workshop Tasks for the Less Educated, Severely Physically Handicapped with Upper Extremity Impairments (W. Alfred, M.A.) 147

DISCONTINUED 1976

Development and Analysis of Employability Factors in Micrographics for Severely Handicapped Clients (M. Watson, M.Ed.)

Quantitation of ST-Segment Changes in Exercise ECG Using Computer Techniques (D. Cardus, M.D.)

Cardiac and Systematic Changes in Coronary Heart Disease After Exercise (D. Cardus, M.D.)

DISCONTINUED 1977

Treatment of the Neurogenic Dysfunctional Bladder by Implantable Artificial Sphincter (D. P. Griffith, M.D.)

TRANSFERRED 1977

Use of a Bladder Neck Device to Provide Urinary Continence (D. P. Griffith, M.D.)

121 Collection and Analysis of Clinical Data on Scoliotic Patients

Principal Investigator:	P. R. Harrington, M.D.	
FY 1976		
Status:	Completed	
Dates:	January, 1968-May, 1975	
Cost:	Annual $63,048 RT Annual $51,242	Projected Total $215,000 RT % of Annual Total 81%
Annual Report Reference:	#13, Page A-4, R-101	

OBJECTIVES:

1. To systematically analyze retrospective clinical data for the more than 1,500 operated and 2,500 nonoperated scoliotic patients;
2. to determine the treatment procedures which may be combined with spinal instrumentation to afford an optimum result and/or to determine the nonoperative treatment which affords the best results, e.g. the Milwaukee Brace;
3. to establish an internationally shared computerized registry for data pertaining to the clinical care and rehabilitation of the scoliotic patient.

METHODOLOGY: Data forms have been devised for recording all information pertinent to the computer analysis. By systematically selecting subpopulations of patients whose treatment has varied with regard to the type of fusion done, the use (or not) of additional bone, the length of the postoperative cast time, and the type of cast among other factors and by comparing the percent of correction maintained at the first, third, and fifth surgical anniversaries. This project has isolated the specific procedures that provide the best long-term result. The patient outpopulations were made up of individuals fitting certain criteria: age, range, curve magnitude, and a single diagnosis of idiopathic scoliosis.

FINDINGS TO DATE: The outcomes of this study indicate that:

1. An underarm body cast had to be worn for a total of 9 months.
2. A Risser body cast (cast from pelvis to chin) was not necessary.
3. Ambulation could be started up to 7-10 days postoperatively.
4. Autogenous iliac bone graft was needed.
5. The amount of correction obtained was greater when the compression system was used.
6. The amount of correction varied significantly depending upon the type of curve one was operating on.
7. Very little difference in regard to the amount of correction obtained was seen in patients 10-20 years of age.
8. Adults obtained significantly less correction than adolescents (48% vs. 65%).
9. Boys obtained less correction than girls.
10. Preoperative casting and traction was not necessary.
11. The adult patient with scoliosis could be surgically operated upon without excessive complications.
12. The procedure worked as well in patients whose diagnosis was other than that of idiopathic scoliosis.
13. The Harrington instruments could be used in other conditions with gratifying results (fracture dislocation of the spine, severe spondylolisthesis, rheumatoid spondylitis, lordosis and mechanical low back pain secondary to instability).

APPLICABILITY:

1. Optimization of the spinal instrumentation procedure can be expected to lead to even greater rehabilitative benefits in terms of increasing the patient's cardiopulmonary efficiency, work capacity, and longevity.
2. Effective nonoperative and/or operative treatment can increase the changes for the patient to assume a positive role in society and can give the patient confidence in securing employment which may help eliminate the need for reliance on public assistance. Not only can effective and prompt treatment reduce the magnitude of the scoliotic curvature and reduce the disability, but it can help reduce the long-term treatment costs.

122 A Work Tolerance Evaluation Research and Training Unit for a Cardiac Rehabilitation Program

Principal Investigator: D. Cardus, M.D.
1976
Status: Completed
Dates: June, 1969-May, 1975
Cost: Annual $92,668 Projected Total $440,000
RT Annual $84,451 RT % of Annual Total 91%
Annual Report Reference: #13, Page A-10, R-105

OBJECTIVES:

1. To develop a computerized laboratory for cardio-respiratory studies
2. to determine the work tolerance of cardiac patients (in particular, patients with ischemic heart disease);
3. to assess the value of physical exercise as a rehabilitative or preventive procedure for ischemic heart disease.

METHODOLOGY: Computer respiratory responses during the performance of physical work are monitored by means of an on-line computer method described in detail by Cardus (1971). Aerobic work capacity is estimated from determinations of heart rate and work load or oxygen intake according to Astrand's classification. This method provides quantitative physiological data which is used for prescribing work in relation to an exercise reconditioning program.

FINDINGS TO DATE:

1. Laboratory computerization — electronic data processing has been accomplished in the laboratory so that; 1) physiological variables recorded during the exercise test can be processed in real time, 2) collection of historical data is standardized, and 3) a data file could be created (Cardus, 1971). All data are entered from appropriate data transmittal forms especially developed for this project.
2. Physical condition of study population — Using Astrand's classification, 45% of the population studied were of average or better physical condition. The conditioning of the subjects appeared to be independent of age. Subjects having had a MI or exhibiting clinical or ECG signs of IHD were found to be of below average work capacity.

   In a sub-population of subjects (144 men from a health club), the most frequent clinical abnormality observed was an alteration in the exercise ECG (28.5%), followed by high blood pressure (13.2%), abnormal resting ECG (10.4%) and high blood lipids (8.0%).
3. Reconditioning exercise — all except one of 12 individuals in a closely supervised program have shown an improved physical condition. Heart rate curves obtained during 20 minutes of reconditioning exercise showed that after training there was an increase in the intensity of work required to produce a certain change in heart rate. The magnitude of increase depends on the training program and the initial physical condition of the individual.
4. Change in ST segment — a method of computer measurement of the area under the ST segment was devised. An attempt was made to quantitate the ST segment change during exercise. This effort had to be discontinued because of insufficient funds.
5. Changes in systolic time interval — after reconditioning the QS_2 showed significant changes which approached the predicted normal values. The LVET changes were not significant.
6. Changes in an index of myocardial contractility (IMC) — in those cases having IMC determined before and after reconditioning exercise program, there seemed to be an improvement of the index in some subjects.

APPLICABIILTY: It is hoped that a computerized unit for cardio-respiratory studies will increase the number and quality of cardio-respiratory evaluations and will reduce the gap between the community needs for this kind of evaluation and the present capability of providing this service.

123 An Investigation of the Cause of Abnormal Electrolyte Distribution and Excretion in Men with Complete Section of the Spinal Cord

Principal Investigator:	J. Claus-Walker, Ph.D.	
FY 1976		
Status:	Completed	
Dates:	May, 1969-March, 1975	
Cost:	Annual $9,114 RT Annual $9,114	Projected Total $29,500 RT % of Annual Total 100%
Annual Report Reference:	#13, Page A-27, R-118	

OBJECTIVES:

1. To obtain a better knowledge of the mechanisms controlling aldosterone secretion;
2. to find a means for returning the body composition of quadriplegics to a normal pattern because the depletion of potassium may threaten the patient's health;
3. to find if depletion of salt is a safe means to decrease calciuria in quadriplegics, knowing that in healthy subjects a reduction in sodium intake and diuretic administration decreases calciuria;
4. to find if part of the angiotensin generated by renin contributes to the maintenance of blood pressure in quadriplegia or if it is primarily utilized by the adrenal cortex to increase aldosterone production.

METHODOLOGY:

1. Urines are collected daily for 2 days from healthy subjects and patients with regulated sodium intake. On days 2 through 7 all subjects eat a diet with restricted sodium intake and salt substitute. Patients and controls continue normal activities. The importance of keeping away from all foods other than those prepared in the kitchen is stressed. Concentrations of sodium, potassium, epinephrine and norepinephrine are measured in the daily urines; aldosterone in plasma is now measured by radioimmunoassay.
2. In order to duplicate the finding that dietary sodium decreases urine calcium losses in healthy subjects, the diet is now continued for 5 more days during which the subjects also receive a diuretic which causes a more rapid sodium depletion, and the concentrations of calcium and phosphorus are measured in urine samples.
3. Plasma renin and aldosterone are evaluated during the normal sodium intake, at the end of 5 days of low sodium intake, and at the end of 5 days of diuretic treatment. To increase the value of the test, the radioimmunoassays are carried out in the same blood sample. Other laboratory methods are routine unless specifically adapted for subjects receiving drugs that are eliminated in the urine. During this experiment, the patient's serum electrolytes are evaluated to be sure an imbalance is not developed and blood hematocrits are taken at regular intervals to determine modifications in the fluid compartments during the diet.

FINDINGS TO DATE: In SCI patients, the electrolyte balance is very labile, thiazide diuretics administration leads to temporary hypercalcemia, hypokalemia, and to excessive and erratic increases in urinary aldosterone and catecholamines; plasma aldosterone and plasma renin activity increase to above normal during tilt, salt depletion, and diuretic treatment. These results indicate that stimulation of renin secretion occurs without integration of the sympathetic nervous system, but that the duration and the intensity of the sympathetic nervous system, but that the duration and the intensity of the response is partially regulated by the brain. The results suggest that the angiotensin generated by the increased renin found in quadriplegics after physical therapy or wheelchair activity may participate in the maintenance of their blood pressure because it does not correlate with a simultaneous increase in aldosterone excretion, as it does in healthy subjects. Thiazide diuretics and potassium administration reduced urinary calcium and collagen metabolites but led to excessive postural hypotension in early SCI patients. The diuretic induced hypotension may be related to a decrease in formation of the physiologically active angiotensin II because the converting enzyme is reduced by the depletion of sodium stores and potassium administration.

APPLICABILITY: The findings of this study will help to maintain normal electrolyte balance in quadriplegics by preventing depletion of exchangeable potassium. The study also will help to determine if the high calciuria of quadriplegics can be reduced safely by diuretic therapy.

124 Research Developments of Lower Extremity Orthotic Systems for Patients with Various Functional Deficits

Principal Investigator:	T. J. Engen, C.O.	
FY 1976		
Status:	Completed	
Dates:	July, 1969-May, 1975	
Cost:	Annual $26,068 RT Annual $8,712	Projected Total $192,000 RT % of Annual Total 33%
Annual Report Reference:	#13, Page A-32, R-120	

OBJECTIVE: To create, develop, and clinically evaluate new designs of lower extremity orthoses which would provide patients with the needed support, medial-lateral stability, and ambulation assistance while being form fitting, lighter in weight and more cosmetically acceptable.

METHODOLOGY:

1. Conduct a detailed and repeatable functional analysis to classify patients with various skeletal or neuromuscular conditions which limit or hinder ambulation.
2. Study and compare these functional deficits in patients by means of a visual recording procedure while emphasizing the relationship of the deficit to the usage of various orthotic systems during graded ambulation tests.
3. Develop and evaluate experimental lower extremity orthotic devices and compare them with conventional braces on the ambulating patient using the criteria established above.
4. Evaluate the possible psychological changes in the patient's self-image and thereby create improved and more cosmetically acceptable designs.
5. As part of the overall methodology, a thorough medical, orthotic, and physical evaluation is made of each patient.
6. Pedometers are used to determine exactly how much walking is being done by each patient in his experimental orthosis.

FINDINGS TO DATE: To date, approximately 1600 applications of the below-knee corrugated polypropylene orthosis have been made. Clinical evaluation of the below-knee devices was successfully completed, both at this Center and during 1971, at the Krusen Research Center of the Moss Rehabilitation Hospital, under the auspices of the National Academy of Sciences. The following is from the Final Report pertaining to the findings of this evaluation:

> "With regard to function, design simplicity, difficulty and time of fabrication, modifiableness after fabrication, patient independence and ease of donning, changeability of footwear, comfort in relation to orthosis-shoe interface, cosmesis, and weight and bulk, the Texas Institute for Rehabilitation and Research (TIRR) ankle-foot orthosis was outstanding."

As a result of this research and development project, the shoe-brace attachment can now be eliminated due to its special design combined with corrugated polypropylene. In the course of research and development, the design has been consistently improved to provide maximum support, medial-lateral stability, and ambulation assistance with minimum weight and substantially improved cosmosis for the patient.

APPLICABILITY: Lighter, more cosmetically acceptable orthotic devices for patients needing lower extremity braces will allow a more functional gait pattern with increase in comfort, convenience, endurance, and poise. With these advantages, the patient's overall rehabilitation progress and job potential will be enhanced.

125 Electrophrenic Nerve Stimulation — A Feasibility Study

Principal Investigator: R. E. Carter, M.D.
FY 1976
Status: Continuing
Dates: March, 1972-July, 1975
Cost: Annual $8,561 Projected Total $21,000
RT Annual $7,838 RT % of Annual Total 91%
Annual Report Reference: #13, Page A-44, R-129
FY 1977
Status: Completed
Dates: March, 1972-March, 1976
Cost: Annual $16,854 Projected Total $49,800
RT Annual $16,434 RT % of Annual Total 98%
Annual Report Reference: #14, Page A-1, R-129

OBJECTIVES:

1. To evaluate the clinical usefulness of electrophrenic respiration for patients with long term apnea due to spinal cord injury or other conditions affecting breathing potential when the phrenic nerve is intact;
2. to provide an effective means of artificial respiration which can supplement and eventually replace the bulky, extremely expensive equipment currently keeping apneic spinal injured patients alive.

METHODOLOGY:

1. Stimulation electrodes are subcutaneously implanted over the phrenic nerve in the neck and a reserved capsule, attached by subcutaneous wires, is implanted over the lower rib cage. A radio transmitter is then applied to the skin overlying the stimulating electrodes.
2. The electrodes are energized by radio induction to produce excursions of the diaphragm, thus producing artificial nerve stimulation and breathing.
3. Post-operative followup methods include monitoring pulmonary ventilation and blood gases with continuous checking of the minimal and maximal electrical threshold of the nerve and the gradual build up of the duration of the stimulation from 20 minutes to 14 or 17 hours on either diaphragm. Criteria are being developed for gradual exercise of the neuromuscular unit until endurance reaches a peak which appears to occur over a 4-6 month period. The procedure will be deemed successful if the patient has totally switched from other positive pressure breathing machinery to electrophrenic respiration except during periods of respiratory infection.

FINDINGS TO DATE: Follow-up studies of four patients continue. In addition, an electronic unit to program each of a pair of electrophrenic stimulators has been developed. The settings give the option of continual stimulation of the left diaphragm, continual stimulation of the right diaphragm, alternating breaths with each diaphragm, or bilateral stimulation of both diaphragms at the same time. The availability of these options has been of particular value in adapting patients to this form of ventilatory assistance.

Both implants continue to function well for the female patient, age 22, who first received a stimulator. She is currently living in an apartment with an attendant and finishing college. The second patient, a male, expired approximately 10 months after being implanted due to causes unrelated to phrenic stimulation. The third patient, an 11-year-old male, is using both phrenic stimulators simultaneously for sitting; he requires only occasional mechanical ventilation for rest at night. The fourth patient, an 8-year-old female, has had a number of problems to date related much more to a lack of family support than to technical difficulties.

A notable accomplishment has been development of a candidate screening program in conjunction with the Neurophysiology Unit. Another accomplishment has been development of an electronic unit to program each of a pair of electrophrenic stimulators.

In summary, the overall evidence suggests that the respiration pacemaker is promising as an alternative to conventional artificial respiration equipment which is expensive, extremely heavy and bulky, and thus an additional handicap to patient mobility. At the same time, it has been learned that successful use of the pacemaker poses a number of stiff requirements involving effective screening procedures, sound surgical techniques, and dependable surveillance and maintenance procedures.

APPLICABILITY: The importance of this problem rests with the effort to provide an effective means of artificial respiration which can supplement and eventually replace the bulky, extremely expensive equipment currently keeping apneic spinal injured patients alive. Such a development would also provide a back-up system allowing one diaphragm to take over for the other, thus freeing the patient and family from worry about possible system malfunctions, particularly during the night. The enhanced mobility afforded by this equipment has reduced the dependency of at least one individual sufficiently for her to return to college. The relatively low cost of this type of respiratory aid also contributed to reducing the expense of maintaining patients with apnea due to spinal cord injury.

126 Psychological Consequences of a Change in Lower Extremity Orthotics

Principal Investigator:	Shalom Vineberg, Ph.D.	
FY 1976		
Status:	Completed	
Dates:	January, 1971-January, 1975	
Cost:	Annual $945 RT Annual $670	Projected Total $3,600 RT % of Annual Total 71%
Annual Report Reference:	#13, Page A-49, R-132	

OBJECTIVE: To assess the attitudinal, behavioral, and social effects of changing from the conventional leg brace to a new corrugated polyprolene orthosis.

METHODOLOGY:

1. A 99-item Self-Perception Inventory was developed to determine a person's feelings about his/her body, the extent of physical restrictions experienced, the degree of acceptance of the impairment, the degree of self-consciousness concerning physical appearance, the degree of interpersonal competence, and the individual's views concerning the future.
2. A diary of activity is kept by the patient to tap possible changes in patient's life style as a consequence of having a functionally and cosmetically superior brace.
3. Patients also view videotaped walking sequences to measure handicap visibility, attractiveness, and social acceptability.

FINDINGS TO DATE: There was no difference between the two brace conditions on the Interpersonal Aspects Factor. Nevertheless, patients did feel somewhat less physically impaired (Factor II) after having worn the polypropolyene brace. Patients compared more favorably to non-disabled subjects on the Freedom of Mobility Scale after they had worn the polypropolyene brace. In terms of behavioral effects, patients spent significantly fewer hours per day by themselves and more hours outside the home when they were wearing the polypropolyene brace. The data based upon judges' ratings generally supported the prediction that disabled individuals wearing the new orthosis would appear less handicapped than those in the other group, though this proved to be an age-dependent effect.

APPLICABILITY: This project will determine whether recent advances in brace design have accomplished their psychological and behavioral goals. The methodology developed will be useful in future studies evaluating the psychological benefits of changes in orthotic devices.

127 Enterobacterial Vaccine as a Means of Controlling Infections in Spinal-Cord Injured Patients

Principal Investigator:	R. E. Carter, M.D.	
FY 1976		
Status:	Completed	
Dates:	April, 1971-March, 1975	
Cost:	Annual $8,517 RT Annual $5,089	Projected Total $27,000 RT % of Annual Total 60%
Annual Report Reference:	#13, Page A-122, R-144	

OBJECTIVE: To develop a vaccine for enhancing the spinal cord injured patient's resistance to enteric infections which are not satisfactorily controlled or are completely resistant to currently available chemotherapeutic techniques.

METHODOLOGY:

1. Organisms are isolated and cultured. After sterilization of the culture product and checking for toxicity, the processed culture product is used for initial skin tests for patient sensitivity.
2. Injections are administered as the patient's tolerance permits.
3. The patient's serum is checked every 3 or 4 months for evidence of titer buildup to the autogenous vaccine.

FINDINGS TO DATE: A patient started on autogenous vaccine in April, 1971, had only one nine-day admission to the hospital as a result of a pulmonary infection. He had had no flare-ups of pyelonephritis until this year when a renal stone was discovered on the right. He had three episodes of febrile illnesses at home associated with frontal and retro-orbital headache but without nausea or vomiting. None of this resulted in an alteration of his intravenous pyelogram or his renal functions. For a 18-month period we continued to maintain a set of maintenance dose every four to five weeks of autogenous vaccine to both **Proteus** and **Pseudomonas.** His blood count remained normal, his weight stabilized and he was no longer anemic. Since the advent of the renal stone, cultures remained persistently positive from the ileal loop and his originally negative hemagglutinins varied but remained positive at a low level.

An additional young female patient began a course of vaccine therapy, but the results were rendered inconclusive because of her family situation which undermined conscientious adherance to the program.

APPLICABILITY: Many patients with severe spinal injury and subsequent complications decrease their resistance to the point where chronic urinary tract infection becomes very difficult to control. The adjunctive use of an autogenous vaccine might enhance host resistance and thus reduce disability, lower long-term costs, and improve rehabilitation outcome.

128 The Use of an Intraurethral Catheter to Provide Urinary Drainage

Principal Investigator:	Roger S. Munro, M.D.	
FY 1976		
Status:	Completed	
Dates:	May, 1973-June, 1975	
Cost:	Annual $18,590 RT Annual $11,385	Projected Total $24,000 RT % of Annual Total 61%
Annual Report Reference:	#13, Page A-133, R-149	

OBJECTIVE: To determine if urinary sterility during urinary drainage can be maintained through initial use of an intraurethral catheter rather than a Foley catheter.

METHODOLOGY: Spinal cord injured patients who require catheterization for urinary drainage will have the intraurethral conduit inserted rather than be placed on constant Foley catheter drainage. Ten patients will be selected for study who are incapable of reflex voiding and who have no urinary infection, no pathology of the upper genitourinary tract, and no previous history of genitourinary disease. Urinalysis, segmental urethral, and urine cultures with colony counts, will be obtained at the time of conduit insertion. Urine cultures with colony counts will be obtained weekly until the device is removed. On a bi-weekly basis, pelvic x-rays will be obtained to detect calcification in the area of the prosthetic device. The device will be removed: upon successful outcome of the primary problem originally requiring urinary drainage, in the event of urinary infection in the presence of the device, upon the appearance of encrustations on the device, or if clinical findings indicate its use is no longer necessary or that other forms of therapy have become preferable.

FINDINGS TO DATE: The device performed well as an alternative to intermittent catheterization, but it did not preserve a sterile urine as well as was hoped. Complications were few and were entirely related to removal of the device. No serious complications directly related to the device were noted. Data are now being prepared for publication sometime during the next 6 months.

APPLICABILITY: In the spinal cord injury patient, preventing initial urinary tract infection due to catheterization in the early phases of management greatly enhances the possibility of regaining bladder function and should contribute significantly to decreases in the incidence of long-term morbidity and invitality.

129 A Cybernetic Study to Control Spinal Reflex Activity in Spinal Cord Injured Patients

Principal Investigator:	**J. Canzoneri, III, D.Sc.**	
FY 1977		
Status:	**Completed**	
Dates:	**July, 1973-March, 1976**	
Cost:	**Annual $32,816** **RT Annual $29,319**	**Projected Total $59,000** **RT % of Annual Total 89%**
Annual Report Reference:	**#14, Page A-70, R-150**	

OBJECTIVES: To produce a research background for the development of a system capable of controlling the reflex response of spinal cord injured patients. Ultimately, this knowledge could be applied to the development of a functional electronic control system which could be substituted for the missing supraspinal control mechanism(s) of spinal cord injured patients.

METHODOLOGY:

1. A group of five to ten patients, who show evidence of severe incomplete or complete lesions of the cervical or upper thoracic segments of the spinal cord, will be studied. Subject selection criteria: (a) spinal cord lesion between levels of C-2 and T-8; (2) flexion withdrawal reflex to stimulation at the plantar surface of each foot can be demonstrated; (3) responses to the patellar tendon easily elicited without producing clonus; (4) voluntary control over the muscles of the lower limbs minimal or absent; (5) tactile sensation of the lower extremities absent; and (6) the crossed extension reflex must be preserved.
2. The spinal cord excitability is tested by measuring the EMG amplitude of the tendon jerk response evoked by an electrodynamic hammer which is instrumented with a force transducer to monitor the strength of the tendon tap.
3. Electrically induced stimuli are applied by means of surface electrodes to the plantar surface, ipsilaterally and contralaterally.
4. Both excitatory and inhibitory conditioning stimuli are used to confine the level of response within a predetermined set of limits.

5. **Instrumentation:** The signal conditioning process consists of integrating the absolute value of the EMG responses to tendon taps over a predetermined period of time and producing a pulse of constant width and amplitude proportional to the integral value of each response. This process is called a response to pulse height conversion (RPHC).

   A dual-channel, voltage-controlled stimulator produces electrical stimuli with desired electrical parameters of pulse width, repetition frequency, train duration, amplitude, and time delay. A Hewlett-Packard 2111 digital computer controls the amplitude of the Electrical stimuli and is used for decision making and as the feedback element of the closed loop control system. Alsorithms have been developed which predict the strength and site of the excitatory and inhibitory afferent input conditioning stimuli.

6. **Analysis of Data:** The integral of the absolute value for a finite length of time is computed on-line for (a) the amplitude of EMG response to each tendon tap as recorded from the elicited muscle response, and (b) the peak force of electrodynamic hammer.

   The integrations are performed by analog techniques and resultant analog signals are used as pre-processed signals prior to A/D conversion and for recording on analog magnetic tape.

   The variations of the integral values from point to point are studied over short periods of time, i.e., 40 seconds and longer periods of time, i.e., 200 seconds. RPHC graphs of these points are made to visualize their trend with time, e.g., to observe habituation, facilitation, depression, etc.

   Online statistical information about the EMG and hammer force data are obtained when the pre-processed analog signals are converted to digital data before transmission to the computer. Mean, variance, and standard deviation values are computed for hammer force and EMG for each test series. Correlation coefficients between the hammer force and the resultant EMG response are thereby determined.

FINDINGS TO DATE:

1. By using afferent stimulation, directed by an automatic closed-loop control system, the magnitude of the output response, which is directly related to the excitability level of the spinal motonerone pool of one muscle, was controlled within a prespecified range.
2. In those patients who had adequate crossed extension reflex, it was demonstrated that within a fair degree of accuracy, their response level could be directed to increase or decrease in value, or made to follow a sinusoidal function.
3. A method of parameter identification was developed in which more than 20 system parameters were identified. The final developed algorithm is quite adaptive provided the rate of change of the uncorrected response is not too great and is somewhat predictable.
4. Results indicate that the control system would perform better on a spinal system which is less disturbed by intrinsic events.
5. In the case where there is total absence of supraspinal control, it is conceivable that multiple parallel input channels could be used to achieve control. This multipath technique, however, should achieve the effect of recruitment of multiple neural fibers for modifying the excitability of the interneurone system as opposed to the use of a single fiber.
6. One present source of error, which could not be avoided, was that the stronger stimuli tended to recruit neighboring fibers of higher threshold whose neurophysiological function was different than what was desired. Therefore unwanted non-linear and reversed effects were produced. There is no simple solution to afferent control of human paralyzed extremities because of at least two important factors:
   a. The available afferent channels have a rather weak influence on spinal motoneurone system with the resulting effects of unpredictability and low resolution.
   b. For practical purposes of external control there is insufficient discrimination to selectively control different muscle groups. For instance, the information produced by one afferent channel might produce a facilitating effect in one muscle group while the same information sent into a different channel might produce an inhibitory effect.

   However, the technique used in this study might be highly valuable in those cases where partial destruction of descending supraspinal channels renders only a weakness to the system. In some cases, this weak system might be augmented with external inhibitory and/or excitatory stimuli. Significant success should be expected since only amplification of the normal feedback signals is required.
7. Some findings interesting from a neurophysiological point of view are:
   a. There is a relatively infrequent occurrence of spinal cord injured patients who have adequate cross-extension reflexes. This implies that the technical approach of this study might be impractical for use in rehabilitation medicine.

b. The effect of electrical stimulation intended to produce excitation might instead produce inhibition or vice versa when a certain strength of stimulation is exceeded.

c. When the variation of excitability exceeds the available range of corresponding conditioning stimuli, only very limited control can result. Also it would be physiologically unsound to apply the amplitude of stimulating voltage required (by this technique) to return the excitability level to the desired range.

8. From the bio-engineering point of view:

a. Poor control can be expected when the short term variations of the excitability level are larger than the intermediate and long time constant changes.

b. Because of the frequency observed inherent long stimulus-to-response delays (2 to 6 seconds), the degree of control was less effective than that desired, even though this delay is partially accounted for by the "residual effect" examining process program.

c. The patients' excitability level, and hence all gains effects and other parameters change greatly in a three hour testing period. Therefore tests with open-loop programs should be performed in succession with only a short interval between each test.

d. Good closed-loop control results cannot be expected if the correlation between the stimulus and response is poor, as determined by the random stimulation program. This is true because in the random mode, the site, and therefore the function, as well as the amplitude is changed often to produce the effect of dishabituation or desensitization and of minimizing the residual effect of preceding stimuli.

e. The resolution of the D/A converters could be greater (e.g. 12 bits instead of 8), so that the available range of stimulating voltages could be divided into smaller increments. This would be especially useful when the actual response is very near the desired response.

f. It is difficult to automatically determine the dynamic characteristics of the system, so that the most linear operating range of the system can be used, and thus avoid the points of saturation and threshold.

g. The final algorithm does not correct for random inputs because it is impossible to make predictions about a purely random signal.

h. There is an optimal time delay between the impact of the hammer on the tendon and the application of conditioning stimuli. The delay for applying inhibitory stimulation is different from that of excitatory stimulation. Tests for determining these delays are very time consuming, but should be performed on each patient at the time of intended control.

i. A small source of variability of the response is attributable to the inconstancy of the force of the hammer tap. This is due to the difficulty of holding the hammer in proper alignment with the tendon while maintaining minimum pressure. This becomes even more difficult in the presence of limb movement due to conditioning stimuli and/or spasms.

APPLICABILITY: It is expected that the findings will contribute to specifying the biomedical engineering requirements for developing a cybernetic system to control motor function of the SCI petients' lower extremities for ambulation and/or to assist motor re-education so as to reduce spasticity and diminish atrophy.

130 Externally Controlled Modification of the Impaired Ambulation of Hemiparetic Patients by Use of Multisite Percutaneous Stimulation

Principal Investigator:	W. A. Spencer, M.D.	
FY 1976		
Status:	Completed	
Dates:	June, 1973-May, 1975	
Cost:	Annual $12,108 RT Annual $7,362	Projected Total $23,000 RT % of Annual Total 61%
Annual Report Reference:	#13, Page A-141, R-151	

OBJECTIVE: To analyze the alterations of foot position patterns caused by electrical peroneal stimulation in patients with drop foot due to stroke.

METHODOLOGY: The study will consist of ten hemiparetic patients, specifically, it will focus on the rotation of the foot following electrically induced dorsiflexion of foot and toes. Recordings will be obtained while the patient walks with and without functional stimulation. An analysis will be made of the possibilities of altering the existing degree of outward or inward rotation by additional electrical stimulation of the skin nerves of the affected leg. Concurrent stimulation will be applied to the saphenous, superficial peroneal, anterior femoral, and/or lateral femoral nerves. Additionally, those skin nerves will be stimulated which belong to the spinal cord segments from which spinal motor outflow for inward and outward rotators of the hip originates.

FINDINGS TO DATE: The first objective of this now completed study was to determine the extent to which the pathological outward rotation of the paretic hip is increased by the usage of FEPB. The results shows that in the 10 ambulatory hemiparetic patients (and 4 normals), there was an extreme increase in outward rotation (Figure 1).

Further results of our gait studies indicate that it was possible in some patients to diminish outward rotation of the involved hip produced by FEPB by simultaneously stimulating one or another of the five sensory nerves (Figure 2).

Statistical analysis of the results of the angular measurements show that not all of these changes are significant though in each patient stimulation of at least one nerve did produce statistically significant correction. When interpreting the statistical results, the following points must be considered:

1. In this study only a small patient population was used with only a small sample number of steps to analyze.
2. The physical parameters of gait are highly variable, not only in this patient population but even in normal subjects. Therefore, a large standard deviation was obtained which tends to decrease statistical significance.

APPLICABILITY: The results of this project will increase the individual's capability for walking. This will reduce the patient's dependency on old fashioned orthotic devices by increasing his likelihood for employment since he will become able to activate his paralyzed movement without using any visible orthotic devices. It is hoped that multisite stimulation will increase the number of patients who are candidates for the functional electrical stimulation system.

131 Attempted Dissolution of Struvite ($MgNH_4PO_4 \cdot 6H_2O$) Urinary Calculi

Principal Investigator:	D. P. Griffith, M.D.	
FY 1976		
Status:	New	
Dates:	December, 1973-November, 1976	
Cost:	Annual $12,442 RT Annual $3,795	Projected Total $34,000 RT % of Annual Total 31%
Annual Report Reference:	#13, Page A-151, R-153	
FY 1977		
Status:	**Completed**	
Dates:	**December, 1973-March, 1976**	
Cost:	**Annual $12,800** **RT Annual $5,967**	**Projected Total $34,000** **RT % of Annual Total 47%**
Annual Report Reference:	**#14, Page A-82, R-153**	

OBJECTIVES: The goal of this project is to dissolve and/or prevent the recurrence of struvite renal stones in a select group of spinal-cord injured patients in whom the incidence of such stones is high. The specific goal is to render the urine maximally undersaturated with respect to struvite by dietary and pharmacological measures and thereby to attempt the dissolution of radiopaque urinary stones associated with **Proteus** urinary infections.

METHODOLOGY: Patients who have radiopaque urinary stones and urinary tract infection caused by **Proteus** alone or in combination with other bacteria will be candidates for this study irrespective of the level of the spinal cord injury or its duration. A complete workup will be performed initially, including biochemical, bacteriologic, radiographic and urologic studies.

The concentration of urinary solutes and the urinary acidity will be manipulated by one or more of the following means:

a. Oral fluid intake may be increased to 5 liters per day or restricted to 1 liter per day.
b. Dietary Ca will be limited to less than 800 mg per day by restriction of dietary dairy products.
c. Dietary Na will be limited as much as tolerated by the patient. A salt substitute may be utilized.
d. Hydrochlorthiazide 50-200 mg per day may be given to reduce urinary calcium and phosphorus excretion.
e. Aluminum hydroxide (Alu-caps - Riker), 1 cap q.i.d., may be utilized to bind intestinal phosphorus and thereby bring about hypophosphatemia and hypophosphaturia.
f. Sodium sulfate (Na_2SO_4); intravenous infusion of sterile, isotonic sodium sulfate may be given to assist urinary acidification.

Follow-up metabolic and urine saturation studies will be made at monthly or more frequent intervals.

FINDINGS TO DATE: Two patients have had complete dissolution of their renal stones. Two patients have undergone partial dissolution, and to date four patients have shown no change in the size of their stones.

Three patients have had complete dissolution of their renal stones. Two additional patients have undergone extensive dissolution though some residual stones remain. Both of the latter patients have solitary kidneys so that surgical treatment involves considerable risk. The other patients have been treated in a similar fashion with little or no change in the size of their urinary stones. We continue to be impressed that some forms of urinary stones — particularly those that are the consequence of urinary infection — may be amenable to peroral dissolution. Standard medications have been used in varying dosage forms to achieve urine that is sterile and undersaturated with respect to various types of stone forming constituents. In summary, this project has served the purpose of confirming the hypothesis that renal stones can be eliminated by pharmacological and dietary means, rather than by surgical procedures alone.

APPLICABILITY: Recurrent urinary stone formation and growth of existing infected urinary stones cause considerable morbidity and mortality. Prevention of stone growth and/or recurrence would markedly improve renal function, reduce the need for recurrent stone surgery and reduce the incidence and severity of pheloneplenitis. Accordingly, the need for hospitalization would be reduced. Success of this endeavor would markedly improve the long term prognosis (50% of World War II paraplegics have died as a result of urological complications) of patients with spinal cord injury.

132 A Longitudinal Study of Depressive Reactions in Persons with Spinal Cord Injuries

Principal Investigator:	E. P. Willems, Ph.D.	
FY 1976		
Status:	New	
Dates:	June, 1974-December, 1975	
Cost:	Annual $6,349 RT Annual $5,914	Projected Total $10,000 RT % of Annual Total 93%
Annual Report Reference:	#13, Page A-156, R-154	

Fy 1977
Status: **Completed**
Dates: **June, 1974-January, 1976**
Cost: **Annual $22,230** **Projected Total $32,000**
RT Annual $18,871 **RT % of Annual Total 85%**
Annual Report Reference: **#14, Page A-88, R-154**

OBJECTIVES:

1. To accumulate a record, over the entire course of the hospital stay, of four measurements hypothesized to relate to depression on four different levels for 10 quadriplegics.
2. To describe phases or extended periods of depressive or elative effect during rehabilitation.
3. To test the traditional hypothesis that a period of depressive reaction or the denial of such a period occurs in the rehabilitation process.
4. To identify significant events in the rehabilitation process; i.e., events that produce significant emotional reactions on the four measures.
5. To develop an ordered taxonomy of such significant events, a taxonomy that might serve as a basis for training hospital personnel in the psychological aspects of hospital care.
6. To order significant events according to the amount of depressive and elative affect they produce.

METHODOLOGY: The following measures were obtained five days each week throughout the hospital stage of 10 quadriplegic patients:

Daily Taping Sessions. Each evening, each patient dictated a record of the day's events into a cassette tape recorder.

Significant Events. All tapes were analyzed for significant events, events which appeared to cause stronger-than-usual emotional reactions in the patient.

Rate of Words Per Minute (WPM). The total number of words in the first three continuous minutes of taping were averaged for a words-per-minute index.

Emotion Report From (ERF) by Others. For the Emotion Report Form (ERF), responses were indicated on bipolar scales. The ERF was filled out 5 days per week by a member of the nursing service as well as by physical and occupational therapists.

Emotional Report Form by the Patient. The ERF was filled out 5 days per week by each patient on the study.

Measurement of Urinary Tryptamine (TRYPT). 24-hour urine samples were collected. A modified version of Oates' method was used to assay the amount of urinary tryptamine.

Reliability. Three separate analyses showed the tryptamine tests to be highly reliable. Independent assessments indicated that the words-per-minute measure was reliable.

FINDINGS TO DATE: Two patterns of emotional responses occurred across the period of hospitalization among the 10 patients. In the first pattern, characteristic of four patients, the number of negative significant-event days (usually sickness or negative doctor's verdict) exceeded the number of positive event days. Strong affective reactions tended to cluster around significant events, admission and discharge, especially on SELF. The second pattern is quite different, but representative in several ways of six patients. The number of positive significant events slightly exceeded the number of negative ones. While many strong affective reactions clustered around admission, significant events, and discharge, many others occurred on control days. These patients reported extreme emotional reactions (SELF) until late in their hospital stays.

In order to test for possible depression-age and depression-level-of-injury patterns, Spearman Rank Order correlations were run on these three measures. None of the correlations were significant. To test the trend hypothesis, that depression is a phenomenon that gradually increases or decreases from onset of injury, all four dependent measures were correlated with time since admission. There was a weak to moderately strong trend on TRYPT and WPM toward the elative direction. The staff (OTHER) tended to agree moderately in their evaluation of patient progress with these behavioral and endocrinal trends, while the patients (SELF) agreed only weakly. There was, therefore, only partial congruence across measures. The stage hypothesis, that there is a definite extended period or stage of extended depressive affect in the rehabilitation process, was tested. There was a slight developmental trend in which patients experienced depressive reactions early in hospitalization on at least one of the dependent measures. However, depression should include an awareness of hopelessness (SELF) as well as lowered rates of behavioral (WPM) and/or endocrine (TRYPT) output. Thus, the depressive trend was either quite slight because it did not show up very strongly on SELF or moderately steep but incongruent with the SELF level of data. The direction of emotion around significant events as compared to control days was hypothesized on the basis of independent coders' ratings of patient descriptions in the nightly taping sessions. Incidents of a similar category (e.g., Doctor's Verdict), coded as negative or in a depressive direction, were grouped together and the common negative direction became the predicted direction on all four dependent measures. Patients reacted significantly on all four levels to many events in the rehabilitation process, but, in particular, to the people (doctors and family) whom they viewed as important. None of these people-related events were hypothesized **a priori.** All of the categories of significant events were rank ordered on each of the four measures of depressive affect. Then, based on the average rank across the four measures, each category was given an overall rank. Two events not usually considered important by hospital personnel, Last Five Days in Hospital, and Day and Weekend Passes, attained the top rankings at the elative end, while two similar events, Told About Prognosis, and Negative Personal Events, had the most depressive rankings. On the other hand, First Self-Feeding, an event usually considered important by hospital staff, also finished quite high in the rankings. The traditional clinical hypothesis posits the need for a depressive phase in order to achieve successful behavioral adjustment. Results indicate that those patients who were least depressed during the hospital phase performed best on two measures of posthospital adjustment while the person who was the most depressed is dead. The middle group of patients were not doing very much by eight months after discharge, but three had taken concrete steps to improve their chances of earning a livelihood. Thus, the traditional hypothesis received little support.

APPLICABILITY: The specific objectives of this study bear directly on a problem of central concern to rehabilitation: behavioral and psychological adjustment. A multimeasure description of the natural history of depression in spinal cord injured patients is precisely the data base needed to address some of the larger, more theoretical issues currently prevalent in the rehabilitation literature. From this data base, significant events in the course of rehabilitation can be inductively identified, along with their associated affective and behavioral correlates. At least the beginnings of a taxonomy of such events can be created which potentially may be very useful in the hands of planners and implementers of rehabilitation programs.

133 A Longitudinal Study of Quadriplegic Young Adults in a Cooperative Self-Support Residential System

Principal Investigator:	J. Cole, Ph.D.	
FY 1976		
Status:	New	
Dates:	June, 1974-July, 1975	
Cost:	Annual $5,328 RT Annual $753	Projected Total $5,300 RT % of Annual Total 14%
Annual Report Reference:	#13, Page A-177, R-157	
FY 1977		
Status:	**Completed**	
Dates:	**June, 1974-May, 1976**	
Cost:	**Annual $8,569** **RT Annual $6,792**	**Projected Total $13,700** **RT % of Annual Total 79%**
Annual Report Reference:	**#14, Page A-132, R-157**	

OBJECTIVES:

1. To determine whether living in the TIRR Cooperative Living residential project influences specified aspects of the behavior and attitudes of residents
2. to provide information for judging the desirability of incorporating features of this cooperative self-support system in the development of further housing projects in Houston
3. to provide information to various state and federal rehabilitation agencies about factors that effect the long-term outcome of rehabilitation programs.

METHODOLOGY: The sample of respondents used in the study has included all residents of the TIRR residential project. This is a total of 40 persons including the 13 present residents. Reasons for this change of focus are discussed at length in Cole (1973).

The following types of information have been gathered from each resident:

1. Intensive interviews are conducted using a standardized interview schedule. The schedule includes questions dealing with demographic information, medical history and status, previous and current residential arrangements, previous and current activities, leisure activities, social networks and patterns of social interaction, information about income and expenses, and attitudes.
2. A measure of the individual's personal behavioral independence is made using a research instrument developed by Frieden in connection with research being conducted by the behavioral ecology research staff at TIRR.
3. Records of financial expenditures are kept by individual residents.
4. Information on each individual's medical history is gathered from TIRR records. A continuing log of all medical problems that occur during residence in the project is kept.
5. Standardized psychological measures are used to gather data on attitudes of residents. These include the Tennessee Self-Concept Scale and the Rotter Locus of Control Scale.

FINDINGS TO DATE: The 40 persons who have been participants in the longitudinal research on the project have been primarily spinal cord injured quadriplegics. There have been 31 males and 9 females. The age distribution has been as follows: 19-21 years (14 persons), 22-24 years (16 persons), 25-27 years (6 persons), 28-33 years (4 persons). Seventeen residents have come from parental homes in urban areas, 16 from parental homes in rural areas, and 7 from nursing homes.

a. The Cooperative Living project has permitted many residents to engage in educational or vocational activities that were inaccessible or could not be supported in their previous living environments. Modeling has played an important part in providing the motivation and the know-how for initiating new activities.

b. A number of residents have increased the number and variety of their social activities since entering the project. Most have learned to be more comfortable and self-confident in a variety of social situations.

c. Most residents who have left Cooperative Living have moved on to more independent living arrangements. Twenty-nine persons are living in apartment clusters that developed as outgrowths of Cooperative Living. Five have developed individual support arrangements with private attendants. Four persons have returned to parental homes and two have returned to nursing homes, one after a period of hospitalization.

d. A number of residents have improved their functional status in the project.

e. Most residents subjectively report important changes in attitudes since entering the project. Examples of such reported changes are the satisfaction of no longer being a "burden" on parents, the satisfaction of assuming responsibility for managing one's own financial affairs, and increased self-confidence in managing social interaction. Such changes have been difficult to measure using standardized psychological instruments.

f. Medical complications have been those typically associated with spinal cord injuries including urinary tract infections, respiratory infections, and skin breakdowns. Data indicate that the incidence of such problems in the project is no higher than in other settings and may in fact be lower than in some settings.

g. The costs for living in the Cooperative Living project where services are shared are less than in alternative living environments. A comparison of average costs is summarized below. Cooperative self-support system — $540; Nursing home — $653; Apartment with private attendant — $820.

h. The experience of Cooperative Living in managing shared services and in coordinating multi-agency sources of financial support has been used in developing four additional housing projects in apartment settings.

APPLICABILITY: The great need for improved housing for the disabled has been widely documented. Residential opportunities are very often prerequisites to achieving basic rehabilitation goals such as vocational productivity and independent living. This is particularly true for individuals with most severe handicaps (IMSH) who receive special emphasis in the Rehabilitation Act of 1973. The results of this study will be useful in making decisions about the types of residential facilities that should be developed and in providing evidence that specially-designed facilities can foster increased independence and productivity of disabled individuals.

134 A Study of Residential Environments for Physically Disabled Young Adults in Houston, Texas

Principal Investigator:	J. Cole, Ph.D.	
FY 1976		
Status:	New	
Dates:	June, 1974-July, 1975	
Cost:	Annual $6,781 RT Annual $753	Projected Total $6,800 RT % of Annual Total 11%
Annual Report Reference:	#13, Page A-186, R-158	
FY 1977		
Status:	**Completed**	
Dates:	**June, 1974-December, 1975**	
Cost:	**Annual $11,219** **RT Annual $6,792**	**Projected Total $14,000** **RT % of Annual Total 60%**
Annual Report Reference:	**#14, Page A-141, R-158**	

OBJECTIVES:

1. To compare four types of alternative residential environments with respect to the following dimensions: demographic characteristics of residents, living space, location in the community, methods of organizing supportive services, managerial structures, social system, activities of residents, living costs,
2. to assess the effects of the above dimensions on the behavior and attitudes of residents,
3. to determine the type of individual who finds different residential environments compatible and suitable for meeting his or her needs, and
4. to provide information as a basis for making decisions about the types of residential facilities that should be developed to meet the needs of disabled persons in this country.

METHODOLOGY: The unit of focus in the study was the residential environment itself. In each setting, interviews were conducted with all the young disabled residents and with as many as possible of the other members of the social system which often included administrative personnel, a staff of attendants, and other residents. Structured observation focusing on the analytic dimensions listed above was also done in each environment. These observations depended upon the training of the principal investigator in cultural and social anthropology and on the type of observer's role that could be developed in each setting. The objective of the study was to view a variety of residential settings from a holistic anthropological perspective and to suggest the factors associated with settings that may influence the behavior of residents.

FINDINGS TO DATE: Interviews and observations made in a variety of residential settings support the following conclusions:

1. Most of the environments studied had basically similar populations of young persons in terms of the types of disabilities represented. The TIRR Cooperative living project was atypical in its high proportion of traumatically disabled spinal cord injured residents.
2. The environments studied fell into two categories. In several settings, residents had small private areas where they slept and kept some personal belongings but shared many other spaces important in their daily routines. This social closeness tended to foster group cohesion and also some degree of conflict in most cases. In the apartment clusters, individuals had much more private space. The residents tended to spend less time with the group of disabled persons as a whole and more time alone or with one or two close friends who often were from outside the project.
3. The location of the residence in relation to other elements of the surrounding community was considered very important by almost all residents.
4. There were four models for providing attendant assistance in the environments studied, each with relative advantages and disadvantages. In all of the settings studied, residents needed more transportation than they had available. Meals were considered a problem by almost all residents except those persons who were either married or able to cook for themselves.
5. The degree of self-determination exercised by residents varies greatly between settings. This may depend not only on the degree of supervision by administrative or staff personnel, but frequently on the expectations of fellow residents as well. The group of residents in some settings can be quite intolerant of individuals who do not adhere to generally accepted behavioral expectations.

6. The issue of a ghetto environment is raised by some residents and outsiders in all of the group settings studied. In some settings this is much more prevalent than in-group solidarity among residents and on stereotyping and negative reactions by outsiders.

APPLICABILITY: The great need for improved housing for the disabled has been widely documented. The lack of appropriate residential opportunities can have important implications for the feasibility of vocational productivity and active community participation. Previous research has indicated that the TIRR residential project and other independent living arrangements have fostered greater functional capability of various residents, reduced dependency, permitted individuals to pursue educational and vocational opportunities that were otherwise inaccessible, contained service costs, served as a model for additional housing alternatives both locally and in other parts of the country, and has led to the establishment of new agency policies and potential new legislation that will facilitate the development of housing for the disabled.

135 Use of Acetohydroxamic Acid (AHA) in Humans

Principal Investigator:	D. P. Griffith, M.D.	
FY 1976		
Status:	New	
Dates:	December, 1973-November, 1976	
Cost:	Annual $21,031 RT Annual $3,450	Projected Total $46,000 RT % of Annual Total 17%
Annual Report Reference:	#13; Page A-225, R-163	
FY 1977		
Status:	**Completed**	
Dates:	**December, 1973-March, 1976**	
Cost:	**Annual $21,031** **RT Annual $3,450**	**Projected Total $46,000** **RT % of Annual Total 17%**
Annual Report Reference:	**#14, Page A-164, R-163**	

OBJECTIVES: The goal of this project is to perform Phase I toxicological and preliminary efficacy studies of AHA in humans. The specific goal is to demonstrate the safety and efficacy of AHA as a pharmacological inhibitor of urease. Use of AHA in patients with **Proteus** urinary infections and radiopaque urinary calculi is expected to decrease stone formation and perhaps promote the dissolution of existing stones.

METHODOLOGY:

1. **General**

   Spinal-cord injured patients who have (1) radiopaque stones in the urinary tract and (2) documented urinary tract infections caused by urease producing bacteria species, will have baseline clinical and laboratory studies. The relationship between the infection and the stone may be established by ureteral catheterization. Antibiotic treatment will be given to attempt sterilization of the urinary tract. AHA will be administered as described below.

2. **Specific**

   Phase I investigations will consider studies of the acute toxicity, the accumulative toxicity, and the chronic toxicity of AHA in humans. Phase I-A studies are expected to involve a minimum of five and a maximum of 10 patients. The following laboratory parameters will be determined during Phase I-A studies: urinalysis, complete blood count; methemoglobin; blood urea nitrogen; blood creatinine; SGOT, LDH, alkaline, phosphatase, glucose, billirubin, total protein, and albumin.

   Phase I-B studies will consist of repetitive daily doses designed along a dosage schedule that will maintain a urinary concentration of 1-4 mg/ml. Phase I-C, chronic toxicity studies, will consist of the administration of repetitive therapeutic doses (i.e., I-B results) to patients for up to six months. Laboratory studies will be performed at monthly interval, or more frequently if signs or symptoms develop. The urinary excretion of AHA will be assayed periodically.

FINDINGS TO DATE: Acetohydroxamic acid (AHA) was administered to 20 patients with chronic **Proteus** urinary tract infections and infected renal calculi. Phase I (acute single dose) toxicity studies were completed. No adverse signs or symptoms developed. The drug was well tolerated. Long-term chronic toxicity studies (Phase II) were initiated in the same patients. Doses of 1.0 grams a day were administered for up to 10 consecutive months. Patients with reduced renal function and patients with normal renal function were treated in a similar fashion. The drug was well tolerated in all patients. There were no significant side effects nor toxicity. Urinary ammonia and pH were reduced consistently in every patient. Significant growth of renal stones has not occurred in any patient receiving AHA. Stone dissolution was not realized, but, urinary chemistries were consistently improved.

APPLICABILITY: Recurrent urinary stone formation of existing infected urinary stones cause considerable morbidity and mortality. Prevention of stone and/or recurrence would markedly improve renal function, reduce the need for recurrent stone surgery and reduce the incidence and severity of pyelonephritis. Accordingly, the need for hospitalization would be reduced. Success of this endeavor should markedly improve the long-term prognosis (50% of World War II paraplegics have died as a result of urological complications) of patients with spinal-cord injury.

136 Comparison of Two Dosage Schedules of Gold in the Treatment of Rheumatoid Arthritis

Principal Investigator:	J. T. Sharp, M.D.	
FY 1976		
Status:	Continuing	
Dates:	October, 1971-September, 1975	
Cost:	Annual $18,712	Projected Total $95,000
	RT Annual $2,501	RT % of Annual Total 13%
Annual Report Reference:	#13, Page A-113, R-138	
FY 1977		
Status:	**Continuing**	
Dates:	**October, 1971-September, 1976**	
Cost:	**Annual $35,447**	**Projected Total $128,000**
	RT Annual $12,997	**RT % of Annual Total 37%**
Annual Report Reference:	**#14, Page A-54, R-138**	

OBJECTIVE: To determine if different schedules of gold used to treat rheumatoid arthritis leave different degrees of effectiveness in treatment.

METHODOLOGY:

1. Patients, matched according to age, sex, presence of nodules, duration of the disease, presence of the positive latex index, and extent of radiologic abnormalities, are assigned to low dose gold therapy or high dose gold therapy.
2. Methods for evaluating the progression of rheumatoid arthritis include evaluation of the extent of joint swelling development or progression of deformities and the occurrence of new or the progression of old radiologic lesions. Functional capacity is assessed by the patient's ability to grip an inflated rubber blood pressure cuff.

FINDINGS TO DATE: A review of the progress of 50 patients who completed 12 months of study was carried out in August and September, 1973. Analysis was performed on the clinical manifestations of inflammation, subjective symptoms, gold blood levels, and progression of radiologic changes. No apparent association of gold blood level with clinical response, progression of disease, or toxic reactions to therapy was found in this group studied for this period of time.

Fifty patients completed two years of study by mid-August, 1974, and 80 patients completed one year of study by October 1, 1974. Our intention was to continue the study until all 80 patients had completed two years. Thus, we anticipated having most of the data ready for key-punching in September or October 1975, and we would complete the analysis of the entire two year study after all patients had completed the treatment program. Activity to date has reached the point of transcribing and keypunching the data. As soon as proofreading is completed, statistical analyses will be undertaken.

APPLICABILITY: Rheumatoid arthritis constitutes one of the major disabling diseases in this country today, and it currently accounts for a major portion of the rheumatic problems in the United States. It is estimated that 10% of disability payments and medical unemployment is due to some rheumatic disorder. More effective treatment techniques are urgently required in order to control the disabling effects of this disease, increase the employability of these patients, and reduce the dependency of those whose disease cannot be completely controlled.

137 Exercise and Lipid Profile in Ischemic Heart Disease

Principal Investigator:	D. Cardus, M.D.	
FY 1976		
Status:	Continuing	
Dates:	May, 1972-September, 1977	
Cost:	Annual $62,965 RT Annual $58,875	Projected Total $192,000 RT % of Annual Total 94%
Annual Report Reference:	#13, Page A-117, R-139	
FY 1977		
Status:	**Continuing**	
Dates:	**May, 1972-September, 1977**	
Cost:	**Annual $133,768** **RT Annual $133,768**	**Projected Total $310,000** **RT % of Annual Total 100%**
Annual Report Reference:	**#14, Page A-58, R-139**	

OBJECTIVES:

1. To obtain leads and trends regarding mechanisms by which physical exercise might have a protective effect on patients prone to or affected by ischemic heart disease;
2. to understand better the changes induced by physical activity on the biochemical "milieu" in order to help in designing programs of physical activity aimed at reconditioning people affected by "hypokinetic diseases" and rehabilitating patients who have had myocardial infarction.

METHODOLOGY:

1. Three groups of subjects are being studied: healthy men, men who have functional signs of ischemic heart disease (without myocardial infarction), and men who have already had myocardial infarction.
2. Each group will be subdivided into a subgroup with a controlled exercise program and each subgroup will undergo periodic testing to assess working capacity and follow the changes in several biochemical parameters.
3. The overall plan of study involves the collection of clinical, physiological, and biochemical data.
4. Physiological measurements are based on the electrocardiogram, phonocardiogram, carotid pulse, and pulmonary ventilation of oxygen and carbon dioxide concentrations in expired gas. The biochemical studies consist of the analysis of biochemical samples (plasma, urine) by regular electrophoresis, isoelectric focusing electrophoresis, ultrafiltration, thin layer chromatography, gaschromatography, and spectrofluorometry.

FINDINGS TO DATE:

a. Development of techniques — determinations of FFA and serum protein fractions have been dropped from the project because of cost in time, materials and lack of funds for new equipment.

b. Data collection — a total of 107 new subjects has been added to the project during the calendar year of 1975. There are at present 135 subjects who have been retested at least one time (71 healthy, 18 having IHD without MI and 46 having IHD with a previous MI). Most of the subjects are engaged in a program of regular exercise, 122 persons exercising compared to 23 persons not exercising.

APPLICABILITY: Programs for the prevention of IHD and reconditioning of persons who have had a myocardial infarction have been for the most part ineffective. Adequate programs are needed for prevention, reconditioning and rehabilitation of persons prone to the disease. A better understanding of the disease is necessary before adequate programs can be designed. This study should give an insight of the changes induced by physical activity on the biochemical "milieu" of the body.

138 Clinical Studies of Calcium in Quadriplegia: Collagen Metabolites and Bone Related Complications

Principal Investigator:	J. Claus-Walker, Ph.D.	
FY 1976		
Status:	Continuing	
Dates:	April, 1972-May, 1976	
Cost:	Annual $45,706 RT Annual $45,706	Projected Total $128,000 RT % of Annual Total 100%
Annual Report Reference:	#13, Page A-126, R-147	
FY 1977		
Status:	**Continuing**	
Dates:	**April, 1972-May, 1977**	
Cost:	**Annual $66,697** **RT Annual $66,697**	**Projected Total $197,000** **RT % of Annual Total 100%**
Annual Report Reference:	**#14, Page A-62, R-147**	

OBJECTIVES:

1. To determine the physiological and pharmacological therapeutics which will prevent the increased bone resorption encountered in acute quadriplegia, avoid the subsequent bone fragility, and reduce the incidence of urinary calculi and ectopic calcification;
2. to study the clinical conditions of calcium and hydroxyproline excretions in paralyzed men and hormones influencing bone remodelling for the 18 months following a traumatic physiologically complete spinal cord transection.

METHODOLOGY:

1. Each year 12 male subjects are selected for participation in an 18-month study. A population of 30 should be adequate for a significant number of patients in each group.
2. A standard diet is routinely given to all quadriplegic patients. Its content varies each day but is constant each week. A metabolic ward is planned to centralize the nursing care and to evaluate exactly the complete food and fluid intake of the patients involved in the research.
3. The patient's first hospitalization is usually 3-4 months, sometimes followed by additional stays of less than 6 weeks.
4. After the initial study during the first hospitalization, samples are collected every 2 months until 18-months post-onset. When patients have been partially rehabilitated and are willing to participate in the research program, they are given a cold water pressor test. Urinary calcium, 17 hydroxycorticosteroids, and blood thyroxine are measured for 3 days prior to the test. On the day of the test, urine is collected for 2 hours prior to and 2 hours during the test, and determinations are made for methylhydroxymandelic acid, epinephrine, norepinephrine, calcium, sodium, potassium, 17 hydroxycorticosteroids, and aldosterone. The 90 minute test consists of having the feet immersed in cold water with blood pressure, heart rate, and body temperature obtained every minute.
5. Bladder calculi obtained are quantitatively analyzed and the urine is examined for its electrolyte concentration and bacterial flora.

FINDINGS TO DATE: Results of the cold pressor test showed that:

1. healthy subjects' blood pressure increased during the test, chronic quadriplegics' did not, and acute quadriplegics' blood pressure increased to a limited extent only;
2. healthy subjects experienced increased rectal temperature and showed immediate evidence of stress, whereas quadriplegics had decreased rectal temperatures and showed only delayed signs of stress;
3. diuresis and saluresis increased in healthy subjects but not in quadriplegics.

Longitudinal studies carried out in 30 SCI patients showed that onset of SCI results first in hyperphosphaturia (2 to 4 weeks duration), second, hyperhydroxyprolinuria, and last, hypercalciuria. The conclusions reached are unchanged:

1. hypercalciuria, present after the injury, may last 1 month to more than 1 year, and there is a progressive change from hyper- to hypocalciuria;

2. the duration, but not the magnitude, of the hypercalciuria is increased by bedrest; bedrest in chronic quadriplegics (2 years or more) with low urinary calcium, phosphorus, and hydroxyproline results in an increase in the excretion of hydroxyproline exclusively;
3. bladder calculi detected in patients with high or low urine calcium are mostly mixtures of calcium phosphate and magnesium ammonium phosphate, and some calcium oxalate; these calculi contain traces of hydroxyproline, indicating that the degradation products of collagen may play a role in the etiology;
4. the blood hormones measured did not indicate drastic and permanent abnormalities: the fasting calcitonin, parathyroid hormone, and thyroid hormone oscillated with normal ranges, while plasma testosterone was low after onset and remains in the low normal range, and growth hormone showed more upward fluctuation than expected.

We have developed methods to separate, isolate, and analyze the various urinary collagen metabolites, to find out their origin and if they influence the formation and aggregation of crystals in synthetic urine. To date, we found that SCI patients have an increased bone and skin collagen catabolism and anabolism that may occur during bedrest without loss of bone calcium. In one patient, ingested tetracycline was incorporated in ectopic bone, but no stone has been examined for fluorescence.

APPLICABILITY: This project will yield a better understanding of the causes of osteoporosis, formation of renal calculi, and metastatic bone and skin ulcers in SCI. These complications interfere with rehabilitation and occur more often and are more severe in those patients who remain mostly in bed. Their metabolic counterpart may be minimized by 6 hours of wheelchair activity. The physiological responses to local cooling gave much information on homeothermic mechanisms in quadriplegics which is helpful in planning comfortable, nonstressful surroundings.

139 Longitudinal Analysis of Patient Behavior

Principal Investigator:	E. P. Willems, Ph.D.	
FY 1976		
Status:	Continuing	
Dates:	May, 1973-January, 1977	
Cost:	Annual $45,867 RT Annual $36,488	Projected Total $140,000 RT % of Annual Total 80%
Annual Report Reference:	#13, Page A-57, R-136	
FY 1977		
Status:	**Continuing**	
Dates:	**May, 1973-January, 1977**	
Cost:	**Annual $105,735** **RT Annual $77,940**	**Projected Total $247,000** **RT % of Annual Total 73%**
Annual Report Reference:	**#14, Page A-6, R-136**	

OBJECTIVES:

1. Completion of the basic, descriptive, longitudinal data base.
2. Behavioral study of the natural history of treatment outcomes in spinal cord injured persons.
3. Development of techniques for measuring performance and adaptation after discharge.
4. Selection of clinically relevant indicators of patient performance.
5. Refinement and efficiency in procedures for gathering data.
6. Continued practice at clinical use of performing data.
7. Development of a general approach to evaluating treatment programs in terms of their impact on patient performance.
8. Validation of other measures.
9. Packaging, dissemination, and training.

METHODOLOGY: **Inhospital Performance:** During the past year, we developed the **standard-form** observation as an alternative to the narrative observation system with which the work began. The turnaround time from observation of a patient to the point of data available for use is reduced from days down to two hours. Data from bed monitors and odometers are mapped onto the performance data to ascertain which **observational measures** are approximated best by the instrumented measures.

Posthospital Performance: Activity records, which are obtained every 10 days from the time of getting up in the morning until going to bed at night, were provided 37 times during the past year by four expatients. As an alternative to collecting posthospital behavioral data with the activity record (diary form), a telephone interview procedure is being developed. Once every month, a member of the research team visits the expatient's home to conduct a negotiability survey of the home environment. During the past year, we have obtained 19 environmental surveys from four surveys from four different patients.

Selection of Indicators: We selected 31 separate, weekly performance measures that were provided by our data system. These included both observation-based performance measures and instrumented measures. Factor analysis of the correlation matrix and a Verimax rotation yielded 5 clearly defined factors. A cluster analysis of the factor space yielded very tight clusters that corresponded almost perfectly to the factors.

Program evaluation: A separate group of investigators conducted a traditional before-and-after assessment of the effects of a change in staff organization. With our ongoing program of patient monitoring, we were in a position to provide a before-and-after assessment of some of the effects of the change on patient performance. We selected two patients who had been observed before the change and then, after the fact, selected two patients (whom we had observed) who matched the earlier ones. We then analyzed the performance data from these four patients (before and after) on a number of dimensions.

FINDINGS TO DATE: FY 1976 was devoted to: (a) continuing and extending the longitudinal data base, (b) updating the control system for managing complex, time related data, (c) pressing the development and testing of alternative monitoring performance after discharge, (d) experimenting with participation in treatment teams, (e) developing techniques for analysis and presentation of data, (f) routinizing quality control (reliability), (g) extending the scope of dissemination, consultation, and application of our approach to other groups and agencies, (h) extending the use of our techniques and data by members of the hospital family, (i) increasing the efficiency of the data gathering system, and (j) the development of instrumented measures for monitoring patient behavior.

Intercoder and interobserver agreements continue to operate at very acceptable levels. The more efficient standard form operates at very acceptable levels of reliability. The more efficient form is also a valid extension of and valid substitute for the older narrative approach. Several hypotheses seem promising. First, it appears that patients whose inhospital performance shows little increase and low predischarge level do much less well after discharge than patients whose inhospital performance shows early, rapid acceleration and high predischarge levels. Second, even with similar predischarge levels, it appears that patients who show early onset of change do better than patients who show late onset of change. Patients show more goal-oriented performance change in some hospital settings than in others. Recent tests of the posthospital environmental survey have included trained personnel from the research project (experienced) and persons with no background on the project (inexperienced). Lack of experience in observational research did not affect agreements adversely. The negotiability data show trends over time and large differences among patients that can be correlated with functional performance and aid in interpreting changes and differences in functional performance. The clusters and the specific measures that loaded highly on their corresponding factors. The loadings were so high and the clusters were so tight that almost any single measure can be selected from within a cluster to represent the cluster — a significant reduction in redundancy. In the evaluation of the staff change, the other investigating team found strong positive effects at the staff level. There were also some effects on patient performance. Generally, after patients spent more time in the ward than earlier patients had spent in ward settings. However, after patients performed unaided (independently) at a higher rate than earlier patients, similar patterns emerged for self-instigation and diversity of performance.

APPLICABILITY: What does our longitudinal approach to performance assessment provide that more traditional techniques do not provide? First, the approach gets to the central issues of rehabilitation, i.e., the dynamic quality of patient adaptation, behavior-environment interaction, and patient-other interaction in ways that no current, relatively static measure do. Second, the approach gets at the actualities of those events directly. Third, the approach provides a relatively holistic view of what patients do beyond the specially arranged, test oriented situations that are reflected in traditional techniques. Finally, the approach emphasizes the cumulative assessment of what patients actually put into use over time and not just what they have been taught in relatively formal, isolated settings. Rehabilitation is essentially a teaching-learning process, and the essence of success in the process is the client's use of the newly learned skills and adaptations on a daily basis. Thus, the most accurate assessment of the degree of success is to document his actual behavior in everyday settings and over periods of time.

140 Evaluation of the Potential Therapeutic Effects of Applying Electrical Stimulation to the Affected Wrist and Finger Extensors and Flexors in Patients with Upper Motor Neuron Lesions

Principal Investigator:	R. Campos, M.D.	
FY 1976		
Status:	New	
Dates:	December, 1973-June, 1976	
Cost:	Annual $20,580 RT Annual $10,964	Projected Total $56,000 RT % of Annual Total 53%
Annual Report Reference:	#13, Page A-164, R-155	
FY 1977		
Status:	**Continuing**	
Dates:	**December, 1973-June, 1977**	
Cost:	**Annual $23,025** **RT Annual $10,026**	**Projected Total $57,500** **RT % of Annual Total 44%**
Annual Report Reference:	**#14, Page A-128, R-155**	

OBJECTIVES: One objective of this study is to explore the usefulness of a period of daily electrical stimulation for modifying muscle hypertonia in the selected muscle groups of the affected hand of patients with spastic hemiparesis. Another objective is to evaluate the possibility of improving functional usefulness of the affected hand in these patients.

METHODOLOGY: For this study, 20 to 30 patients will be screened to find those who some preserved volitional control of the flexors of the wrist and fingers with associated muscle hypertonia and weak or no volitional control of extensors of the wrist and fingers. The method used for screening will consist of clinical evaluation of the functional status of the affected hand by examination of the sensory function including skin sensation, two-point discrimination, position sense, stereognosis, and graphesthesia.

Investigative evaluation procedures will include:

1. Neurological examination with special emphasis on evaluation of preserved hand function (two-point discrimination, position sense, stereognosis, graphesthesia, apraxia, etc.) will be conducted. Findings from the affected side will be compared with the findings of the non-affected side.
2. Goniometric measurements of passive and activce wrist flexion and extension from the non-affected side will be used as controls throughout the study.

FINDINGS TO DATE: During the current reporting period, the instrumentation and recording techniques have been finalized and six patients have been entered into the program as users of this reciprocating stimulation. All of these patients have been seen for both the preliminary and three-month evaluations and two of the patients have had the six month evaluation. There have been no changes in the clinical condition of the patients. However, there has been a subclinical improvement in both spasticity and selective voluntary recruitment as evidenced by electromyographic recordings taken at the three and six month evaluations.

A total of 14 patients have been entered to date into the program as users of reciprocating stimulation. All of these patients have been seen for both preliminary and three-month evaluations and six have had the six-month evaluation. There have been no changes in the clinical condition of the patients. However, there has been a subclinical improvement in both spasticity and selective voluntary recruitment as evidenced by electromyographic recordings taken at the three and six-month evaluations.

APPLICABILITY: Most patients with upper motor neuron lesions due to stroke or head injury suffer from some form of upper extremity paralysis. It is expected that alternating stimulation of the wrist and finger extensors and flexors will not only have an effect on reciprocal inhibition of the antagonistic muscle groups but will also activate other spinal and central nervous system mechanisms which are involved in the impaired hand. The suppression of hyper-excitability in other muscle groups of the arm and the activation of otherwise inactive motor outputs is expected to re-establish equilibrium in wrist and finger positioning and to facilitate preserved motor control by diminishing muscle hypertonia in the flexors of the wrist and fingers yielding a more functional hand.

141 Development of an Optimal Discriminant Function for the Early Detection of Scoliosis

Principal Investigator:	R. E. Herron, Ph.D.	
FY 1976		
Status:	New	
Dates:	September, 1974-September, 1977	
Cost:	Annual $21,272 RT Annual $3,989	Projected Total $57,000 RT % of Annual Total 19%
Annual Report Reference:	#13, Page A-209, R-161	
FY 1977		
Status:	**Continuing**	
Dates:	**Sept., 1974-September, 1977**	
Cost:	**Annual $35,797** **RT Annual $35,058**	**Projected Total $78,000** **RT % of Annual Total 98%**
Annual Report Reference:	**#14, Page A-150, R-161**	

OBJECTIVES: This research will develop guidelines for designing a screening procedure by synthesizing from biostereometric data on scoliotic and normal patient populations a set of measurements which discriminate the two conditions. A potential future development from these measurements is a discriminant function for classifying individuals as normal or "potentially scoliotic" on the basis of body configuration.

METHODOLOGY: Data on the whole body geometry in scoliosis will be derived from 25 sets of anterior and posterior stereograms chosen from among 50 such sets taken preoperatively of patients presenting for surgical correction of spinal curvatures at the Methodist Clinic. Normative data will come from the same number of stereograms of comparable normal subjects.

In addition, 36 inch standing AP radiographs will be taken of non-patient subjects (this information routinely is filed for patients) as well as height, weight, and dominant handedness, other information pertinent to muscular or skeletal development.

Established standards of posing will be employed to minimize changes in body configuration due to postural variations. These standards will be tested for their applicability to scoliosis and an effort will be made to identify additional poses which will more clearly reveal the effects on body geometry of a spinal curvature.

Data Analysis

The whole body data generated for each group will form the basis for a series of measurements that are possible indicators of abnormal development. Evaluation of such parameters as bilateral symmetry of volume and surface, horizontal rotation of trunk segments and location of center of gravity will reveal their relevant information content and seek to establish a pattern peculiar to each group. This evaluation will be facilitated by the recent acquisition of a Tektronix 4012 interactive graphics terminal, on which the effects of the pattern choice can be readily observed. From these patterns will be derived an optimal set of discriminant tests, based on three-dimensional spatial information, which can then be tested for its sensitivity in detecting developing spinal curvatures.

FINDINGS TO DATE: The data acquisition phase initiated in FY 1976 reflects the development of stereometric procedures during a previous RT-4 project, "Comparative Stereophotogrammetric Analysis of Spinal Configuration in Scoliotic Patients and Normal Subjects," Project No. R-121. By coincidence, one of the subjects presented for evaluation during the present data acquisition phase had participated in the previous study.

During the reporting period FY 1977 stereometric data acquisition was completed postoperatively for 45 of the 50 subjects for whom pre-operative records exist. Simultaneous duplicate stereopairs of each individual precluded the loss of data through equipment malfunction or breakage of the glass plates.

APPLICABILITY: A means of detecting scoliosis at an early stage of development means that conservative treatments can be effectively applied. The procedure is non-hazardous, and therefore suitable for screening applications. The photographs themselves, moreover, are a permanent record of the subject's body form which can be analyzed at any later date for information regarding growth, efficacy of treatment, or areas of improvement.

The incidence of idiopathic scoliosis among adolescent females is estimated at slightly over one per cent (Baker & Zangger, 1970). This estimate ignores the potentially higher incidence of structural curves too small to be treated or even detected, by conventional examination procedures. The stereometric procedures outlined above will yield information about these incipient orthopedic problems and their relation to posture, growth and development.

The data analysis will be limited to evaluating three dimensional parameters for information relevant to detecting spinal curvatures.

Inasmuch as stereometric records of pre-operative scoliosis patients form the data base for these evaluations, the relative ease of acquiring post-operative records of the same group suggests a change of focus to provide more information about what to measure and how to quantify the effects of scoliosis on body geometry. Analysis of these records will explore the use of biostereometrics to display and define the results of surgical intervention on body geometry.

142 A Study of Factors Related to Personal Independence Gains of Spinal Cord Injured Patients During Initial Rehabilitation Care

Principal Investigator:	Susan Baker, M.F.A.	
FY 1976		
Status:	New	
Dates:	June, 1975-December, 1976	
Cost:	Annual $10,415 RT Annual $2,760	Projected Total $22,000 RT % of Annual Total 26%
Annual Report Reference:	#13, Page A-217, R-162	
FY 1977		
Status:	**Continuing**	
Dates:	**June, 1975-June, 1977**	
Cost:	**Annual $11,091** **RT Annual $5,443**	**Projected Total $22,000** **RT % of Annual Total 49%**
Annual Report Reference:	**#14, Page A-158, R-162**	

OBJECTIVES:

1. Test the reliability and validity of the instrument and method used for evaluating personal independence (EPI) at the TIRR.
2. Evaluate the effectiveness of the rehabilitation process in assisting the patient achieve maximum personal independence.

METHODOLOGY:

1. A summary will be provided of available literature using the specific parameters including purpose, associated disabilities, ADL items included, data collection and computation reliability studies, and validity of results.
2. A description and critique will be provided of ADL methods most applicable to evaluation of the generally disabled for daily care management and administrative purposes.
3. A detailed analysis of a representative ADL method (i.e., TIRR) will include a study of the value of a weighting scheme for individual activities of daily living, redundancies of the activities required for the patient's evaluation, reliability of the evaluation method, and the validity of the ADL score.
4. Based upon the results of the literature critique and the TIRR-ADL analysis, recommendations will be provided for a method of ADL evaluation most suited for rehabilitation care and policy making.

PROGRESS AND FINDINGS:

1. No one ADL scale published in the literature, or the TIRR-ADL scale, is clearly the most advantageous for evaluating rehabilitation services effectiveness. However of those scales designed for routine care of the generally disabled, the "Barthel-Granger Index," "Index of ADL," and "Kenny Self-Care Evaluation" scales offer the most potential for rehabilitation evaluation and planning. This conclusion is reached mainly because only these three scales have been studied for reliability and/or validity, are relatively simple to compute, and are adaptable to fulfill most of predefined criteria.
2. **TIRR-ADL Method.** There is little difference in the weighted and unweighted scores and thus for the purposes of a total score representing personal independence, the weights are unnecessary. **Redundancies of Items:** Almost all the ADL items are correlated among themselves as well as with the total score. At most, 19 items (vs. currently used 49) are required for the TIRR-ADL total score to represent personal independence level. **Reliability:** There is a high correlation (coefficient, .91) between two therapists using the TIRR-ADL method for testing 15 patients' personal independence in ADL. **Validity:** There is a high correlation (coefficient, .89) between the results of the TIRR method and a comparable method (i.e., Kenny method) but it is recommended that additional predictive validity studies be done.
3. **Recommendations:** No one scale necessarily fulfills the needs of all facilities. One may prefer a method with fewer ADL items vs. a more complete coverage of ADL. This research provides a synthesis of ADL evaluation parameters from which an appropriate evaluation tool can be selected (and modified).

APPLICABILITY: This research shows that most reported ADL scales fall short in meeting minimum criteria for rehabilitation services evaluation. However, the results of this study should contribute to others' understanding of its strengths, weaknesses, ambiguities, and potential. If a new scale is being considered, this report should provide ideas for development of such a scale as well as a model for its evaluation and reporting. If rehabilitation services are to be effective, there must be a common purpose and subsequent unified effort toward the use of adequate methods for evaluating such services appropriate for all facilities/institutions. It is toward this goal that this research has been directed and for this purpose the results intended.

143 Analysis of Information Processing Training for the Severely Disabled

Principal Investigator:	**M. Sanderson, B.S.**	
FY 1977		
Status:	**Continuing**	
Dates:	**July, 1975-June, 1978**	
Cost:	**Annual $55,915** **RT Annual $6,951**	**Projected Total $165,000** **RT % of Annual Total 12%**
Annual Report Reference:	**#14, Page A-200, R-170**	

OBJECTIVES:

1. To demonstrate the feasibility of placing suitably trained, severely disabled persons in the various fields of information processing including keypunching, communicating magnetic selectric typewriter, tape certification, key-to-tape entry and remote terminal data entry.
2. To develop effective procedures for selecting suitable, severely physically impaired trainees and to create effective training programs for them in the area of information processing.
3. To demonstrate the feasibility of obtaining subcontracts from business that produce revenue for the program and give trainees actual production experience before an attempt is made to place them in fulltime career position.
4. To explore the feasibility of developing a skills training program that will allow even the most severely physically limited individuals to obtain productive jobs in data processing.

METHODOLOGY: The procedures which will be followed can be divided into three sections.

1. Client training – severely disabled clients will be screened for appropriateness and those accepted will be trained on the CMC/ST, ATS, keypunch or tape certifier. The program is flexible in length, with an average training time of 3 months. Every effort will be made to obtain jobs for those completing training.
2. Business development – subcontracts will be obtained from Houston area businesses to give trainees experience on production oriented jobs before they are placed.
3. Computer program evaluation – programming training courses will be evaluated to determine feasibility for training the most severely disabled. Placement efforts will be made for all who finish such a course. Average training time: 6 to 8 months.

FINDINGS TO DATE: Eleven severely disabled clients (of 16 total) have been trained. About half of these were placed in jobs. Keypunch has proven to be the most viable field as CMC/ST and ATS training require extra skills in proof-reading and editing. Job seeking skills need to be included in any training program to insure successful employment after training. New efforts with TRC-IBM-Goodwill have begun to develop a training program in computer programming for the most severely disabled.

APPLICABILITY: The successful realizations of stated PIP objectives will open the doors to new career opportunities for the severely handicapped. For those capable of working in competitive work situations the ability to earn income at levels above minimum wage will substantially decrease their dependence on government financial support and offer them opportunities for independence from families that might not have existed previously. The development of subcontract work will give individuals who are unable to work a full day or up to normal production rates the chance to contribute to their own support on a more limited scale. Subcontract work will also lessen the extent to which PIP requires federal grant funds for its continuation.

144 Treatment of the Neurogenic Dysfunctional Bladder by Implantable Artificial Sphincter

Principal Investigator:	D. P. Griffith, M.D.	
FY 1976		
Status:	New	
Dates:	December, 1973-November, 1976	
Cost:	Annual $27,316 RT Annual $2,041	Projected Total $81,948 RT % of Annual Total 10%
Annual Report Reference:	#13, Page A-147, R-152	
FY 1977		
Status:	**Discontinued**	
Dates:	**December, 1973-July, 1976**	
Cost:	**Annual $8,595** **RT Annual $840**	**Projected Total $13,250** **RT % of Annual Total 10%**
Annual Report Reference:	**#14, Page A-78, R-152**	

OBJECTIVE: The objective of this program is to provide volitional control of bladder function to patients who have neurogenic dysfunction of the urinary bladder. Inherent in this objective is the establishment of criteria for selecting candidates for use of the artificial sphincter.

METHODOLOGY:

1. **General**

All patients will undergo routine biochemical and radiographic studies. All candidates will be evaluated urologically to include cinecystrography, intravenous pyelography, cystoscopy, uroflowmetry, cystometry, sphincterometry, and perineal electromyography. These studies will be done before and on some occasions subsequent to the implantation of the apparatus to evaluate its effectiveness. All candidates for the incontinence device must demonstrate adequate bladder evacuation. Surgical procedures prior to or coincident with implantation of the artificial sphincter may be utilized to ensure bladder evacuation. The sphincter will be implanted around the urethra and distal to the bladder neck through a midline abdominal incision which will remain extraperitoneal. In men, the peri-urethral cuff may be placed around the bulbous urethra rather than the prostatic urethra.

2. **Specific**

Selection of Patients: Those patients for whom there is no good alternative method of treating their neurogenic vesical dysfunction will be candidates. Patients will not be recruited. They will be informed of the developmental nature of the procedure with its associated risks and hazards. All alternative medical and surgical treatment modalities will also be discussed with the patient.

All preoperative and postoperative clinical data will be catalogued. Diagnostic studies include radiographic, bacteriologic, biochemical, and urodynamic investigations.

FINDINGS TO DATE: Three patients with spina bifida and neurogenic vesical dysfunction have undergone implantation of the Scott Artificial Sphincter. One patient (male) has a perfect result. He is volitionally continent and has sterile urine. Volitional continence was not realized in two female patients and the prosthesis has been removed from both.

APPLICABILITY: Restoration of near normal control of bladder function will yield major psychologic, physiologic and sociologic benefits. Patients are expected to develop a better image of themselves. They are expected to feel more completely rehabilitated. Recurrent and/or chronic urinary infection is expected to be less prevalent. The urological sequelae attendant to urinary infection and urinary stone formation are also expected to be less prevalent. Patients are expected to be less dependent; loss of time because of urological sequelae should be minimized. The need for future hospitalizations and repeated urological procedures is expected to be reduced.

145 Retention of Habituation of Reflex Activity Mediated by the Transected Human Spinal Cord

Principal Investigator:	**M. J. Fuhrer, Ph.D.**	
FY 1977		
Status:	**New**	
Dates:	**July, 1975-December, 1977**	
Cost:	**Annual $38,855** **RT Annual $19,991**	**Projected Total $89,000** **RT % of Annual Total 52%**
Annual Report Reference:	**#14, Page A-175, R-166**	

OBJECTIVES: After having developed a basic experiment paradigm for demonstrating retention of habituation of the flexor reflex in spinal man, additional studies will be devoted to:

a. assessing the degree of retention as a function of the time since habituation training;
b. determining the effects on retention of continuing habituation training beyond the point that responsiveness is extinguished;
c. establishing whether retention is prolonged by widely spaced applications of the habituating stimulus during the retention interval; and
d. investigating whether more persistent retention is achieved by distributing habituation training over a number of discrete periods.

METHODOLOGY: Each study will involve a minimum of nine male patients with a functionally complete transection of the cervical spinal cord of more than 12 months duration. The raw and integrated EMG activity of the tibialis anterior muscle and of the rectus femoris will be recorded unilaterally from the leg to be stimulated. Constant-current, electrocutaneous stimulation will be applied through clip-on electrodes attached to the mid-plantar surface and to the dorsal aspect of the foot at the base of the fifth toe. Habituating stimulation is applied at the rate of 1/sec until all EMG responsiveness is extinguished. Following a stimulus-free retention interval that is varied depending upon the particular study involved, the series of 1/sec stimulation is reinitiated and continued until extinction again is obtained.

FINDINGS TO DATE: The interfacing circuitry and computer software for digitizing the EMG have been finalized. The basic experimental paradigm for demonstrating retention of habituation has been pilot-tested and finalized. The four related studies outlined under "Objectives" were initiated and computer programs for quantifying retention of habituation and changes in retention as a function of experimental interventions are being developed.

APPLICABILITY: By using carefully programmed electrical stimulation of the skin or of peripheral nerves lying just under the skin, intrinsic neural control mechanisms can be brought into play which eventuate in reduced reflex activity. After the potentialities and limitations of this approach have been established, it will be possible to specify biomedical engineering requirements for developing practical methods of functional electrical stimulation to eliminate excessive reflex activity (including muscle spasms and exaggerated sweating) which interfere with the residual capabilities of these patients.

146 Immediate Stabilization of the Fractured Thoracic and Lumbar Spine with and without Neurologic Deficit

Principal Investigator:	**J. H. Dickson, M.D.**	
FY 1977		
Status:	**New**	
Dates:	**July, 1976-June, 1978**	
Cost:	**Annual $48,690** **RT Annual $15,207**	**Projected Total $83,000** **RT % of Annual Total 31%**
Annual Report Reference:	**#14, Page A-182, R-167**	

OBJECTIVES:

1. To document from an orthopedic standpoint the degree and durability of stabilization that is achieved by instrumentation applied shortly after fracture of the thoracic or lumbar spine.
2. To document how soon following surgery the patient can be made bed-free in order to participate fully in the rehabilitation process.
3. To describe the impact of the instrumentation procedure upon minimizing complications (urologic, integumental, etc.) which frequently accompany severe spinal injury.
4. To communicate the benefits of spinal instrumentation to orthopedic surgeons and neurosurgeons caring for patients with severe spinal injury.

METHODOLOGY: Records of patients having had fracture dislocation of thoracic and/or lumbar spine will be evaluated for:

1. Functional level at time of injury and at last follow-up.
2. Manual muscle testing performed at periodic intervals.
3. Time until patient is able to sit 6 hours a day.
4. Degree and type of fracture dislocation.
5. Amount of correction and stability developed by surgery and at follow-up.
6. Complications of surgery.

FINDINGS TO DATE: 92 patients' records have been evaluated. Twenty-nine of the 34 patients who had incomplete spinal cord lesions have shown some return of function, some rather dramatic. The average time until sitting six hours a day in a wheelchair has been three weeks from the time of injury in those patients operated on within one week of their injury. The initial evaluation showed that results were the same if the surgery was done within one week of injury. From a statistical view, however, many more cases are needed to analyze this completely. Reduction was almost anatomic in cases done within seven days of injury and remained so at the last follow-up.

APPLICABILITY: Systematic documentation of patient outcomes achieved by immediate stabilization of the unstable fractured spine will permit this approach to be compared with outcomes achieved by the non-surgical approach involving protracted bedrest. It is expected that the comparison will show that immediate stabilization permits the patient to much more rapidly and actively become engaged in the inpatient rehabilitation process, thus shortening its duration. As a result, the patient can proceed more quickly pursuing the educational or vocational aspects of rehabilitation. These outcomes have obvious implications for reducing the costs of rehabilitative care — as does the likelihood that immediate stabilization will eliminate the costly complications of extended bedrest including urologic, skin, metabolic, and peripheral vascular problems.

147 Appropriate Entry Level Jobs and Sheltered Workshop Tasks for the Less Educated, Severely Physically Handicapped with Upper Extremity Impairments

Principal Investigator:	**W. Alfred, M.A.**	
FY 1977		
Status:	**New**	
Dates:	**July, 1975-June, 1980**	
Cost:	**Annual $54,510** **RT Annual $27,169**	**Projected Total $190,000** **RT % of Annual Total 50%**
Annual Report Reference:	**#14, Page A-186, R-168**	

OBJECTIVES: To identify, test, and ultimately validate a variety of entry level jobs and sheltered workshop tasks which can be performed remuneratively by the less educated, severely physically handicapped with extremity impairments.

METHODOLOGY: In terms of the severely physically handicapped, the project includes the disability groups with which the RT-4 Center is identified, viz., spinal cord injury, neurological disease, brain injury, CVA, skeletal systems deformities, amputation, multiple sclerosis, muscular dystrophy, birth defects, chronic and severe arthritis.

From these disability groups, the project is limited to those subjects who manifest functional impairments in one or both upper extremities such as paralysis, spasticity, weakness, amputation, incoordination, deformity, and limited range of motion.

It is estimated that approximately 15-30 with the aforementioned disabilities and functional impairments will be entered into the program each year. The referral sources will include TIRR and the Texas Rehabilitation Commission.

To date, information on 14 clients has been registered into the project.

1. Entry level jobs for this project are defined as jobs which require no specific vocational preparation beyond on-the-job training and/or less than six months of skills training. The criteria by which a severely handicapped person is judged as successfully and gainfully employed are: (a) receipt of minimum wages or above; (b) demonstrated ability to perform job assignments; (c) maintenance of employment for a minimum of 30 days.
2. The Vocational Counselor has been assigned to search and identify the appropriate subjects employed in entry level jobs as well as to obtain relevant ID, medical, and vocational data. The Chief Evaluator has been concerned with measuring the functional capabilities of persons with upper extremity impairments relating their residual capabilities to efficient task performance, and on occasions to perform job site visits to appraise their job performance and make recommendations for improvement. The Placement Counselor has been involved with on-site visits where subjects are employed in order to elicit relevant job information as well as to obtain employer's appraisal of subjects performance on their jobs.

3. For sheltered employment to be considered remunerative, the handicapped individual must demonstrate that he is capable of producing work at a rate of not less than the minimum floor wage that has been established by the U.S. Department of Labor for sheltered workshops; that is not less than 50% of the minimum labor wage. At TIRR's WAP, the floor wage is $1.00 per hour. If a worker's productivity falls below this level, then he is considered as a slow and unproductive worker who cannot generate enough income to contribute to the financial solvency of the workshop operations and programs.
4. The Workshop Director and the Coordinator of the MG Program are responsible to identify, test, and validate workshop tasks that can be successfully and consistently performed by subjects to meet the range from minimum floor wage level to competitive standards. The Contract Procurer is involved in selectively pursuing appropriate subcontract work that can be performed by the severely disabled. The Professional Engineer is concerned with modifying work requirements and establishing motion economy procedures that will maximize the productivity of the severely disabled to the highest possible level.
5. The Coordinator of Rehabilitation Services who is the principal investigator, is coordinating the entire project and is responsible for developing the dissemination format through collaboration with other RT centers, sheltered workshops, evaluation centers, state rehabilitation agencies, and other rehabilitation professionals. A decision as to which specific data to acquire for the inventory of entry level jobs has been finalized.

FINDINGS TO DATE: The final format resulted in a composite job inventory which contains:

1. identifying a client profile which contains vocationally relevant information and history about the disabled individual;
2. a job profile which presents basic facts about the job including identification information, employment requirements, job duties, and working conditions;
3. a client/job profile which reveals an assessment of disability/job factors, work modifications, and client benefits.

In order to complete the job inventory in an objective and standardized manner, a structured recording sheet utilizing scale was developed along with an explanatory sheet which defines terminology and interprets the materials.

To date, data on entry level jobs have been completed on 15 severely disabled clients who have been placed by the RT-4/TIRR Vocational Department.

Currently, plans are underway to develop and finalize a similar format for reporting on appropriate sheltered workshop tasks for the severely disabled.

APPLICABILITY: The potential benefits of the project can lead to improved vocational services for the less educated and severely physically handicapped population with upper extremity impairments in a number of ways:

1. development of more appropriate vocational assessment techniques;
2. development of more adequate sheltered workshop programs to meet their needs;
3. improvement in vocational rehabilitation guidance and counseling services;
4. increase in number of job opportunities and placement possibilities for them;
5. reduction in their financial dependency on government sources;
6. greater increase in their social and economic independence.

Emory University (RT-6)
Medical Rehabilitation Research and Training Center

CORE AREAS

Medical

Research to determine the etiology, natural history, and the effects of various approaches to management of neuromuscular skeletal disorders, thereby reducing impairment.

Psychosocial

Research to determine the effects of societal influences on neuromuscular skeletal disorders and the modification of these influences to reduce disability.

Vocational Rehabilitation

Research to determine those factors which influence vocational achievement and to modify those factors to increase productivity.

EMORY UNIVERSITY

John V. Basmajian, M.D., Director
Emory University Medical
Rehabilitation Research and Training Center
80 Butler Street, S.E.
Atlanta, Georgia 30303

PROJECT TITLE BY FY 1977 STATUS

COMPLETED

ABSTRACT NO.

Heliomagnestat Study #2 — Heliomagnestat (TM) in Pain States — Long-Term Study (Samuel B. Chyatte, M.D.) 148

Evaluation of a Sonic Urinimeter for Blind Diabetics (Gary Kelly, B.S.) 149

Effects of Specific Cutaneous Cold Stimulation on Motor Control in Cat and Man (W. D. Letbetter, Ph.D.) 150

Spinal Muscular Tone of Scoliosis Patients in Siblings (J. V. Basmajian, M.D.) 151

CONTINUING

Hormonal Agents in Myopathy (D. Rudman, M.D.) 152

Heliomagnestat Study #3 — The Heliomagnestat (TM) in Pain: A Reinforcer in Contingency Management of Low Back Pain (S. F. Brena, M.D.) 153

Heliomagnestat Study #4 — The Heliomagnestat (TM) in Back Pain: A Bio-Engineering Evaluation of Motor Performance During Treatment (S. B. Chyatte, M.D.) 154

Evaluation of Exercise after Myocardial Infarction National Exercise Heart Disease Project (NEAHDP) (C. A. Gilbert, M.D.) 155

Cognitive Assist in Motor Learning (C. Gonnella, Ph.D.) 156

The Employment Potential of the Severely Disabled Young Adult (Samuel B. Chyatte, M.D.) 157

Improvement of Function of Spastic and Stroke Patients by Means of Biofeedback (J. V. Basmajian, M.D.) 158

The Implications of the Socio-Cultural Background of Clients to Rehabilitational Personnel and Training (Carole E. Hill, Ph.D. and Nancy Kutner, Ph.D.) 159

Clinical Field Trials of the Emory Detachable Electric Powered Drive for the Standard Wheelchair (Alfred Morris, Ph.D. and C. Gonnella, Ph.D.) 160

Scientific and Clinical Testing of New Experimental Drugs (J. V. Basmajian, M.D.) 161

NEW

The Use of Motor Unit Potentials as a Measure of Neuromuscular Integrity (S. L. Wolf, Ph.D.) 162

A Re-evaluation of Sensory Testing in Neurological Patients (S. L. Wolf, Ph.D.) 163

TRANSFERRED 1976

Intracellular Studies of a Specific Ia-Alpha Organization (William D. Leftbetter, Ph.D.)

Dantrolene Na Long-Term Follow-Up Study (S. B. Chyatte, M.D.)

Muscular Factors in Hip Dysplasia (J. V. Basmajian, M.D.)

REVISED 1976

Heliomagnestat (TM) in Pain States (S. B. Chyatte, M.D.)

The Employment Potential of the Severely Disabled Young Adult (S. B. Chyatte, M.D.)

148 Heliomagnestat Study #2 — Heliomagnestat (TM) in Pain States — Long-Term Study

Principal Investigator: **Samuel B. Chyatte, M.D.**
1977
Status: **Completed**
Dates: **June, 1973 — February, 1975**
Cost: **Annual $10,236** **Projected Total $24,530**
RT Annual $1,236 **RT % of Annual Total 12%**
Annual Report Reference: **#12, Page 38, R-24**

OBJECTIVES:

1. To evaluate the use of a new device for relief of pain.

METHODOLOGY:

1. 10 subjects with pain were treated.
2. Pain ratings and strength ratings were performed.

FINDINGS TO DATE: The device did not seem to be more effective than a placebo and the study was terminated.

149 Evaluation of a Sonic Urinimeter for Blind Diabetics

Principal Investigator: **Gary Kelly, B.S.**
1977
Status: **Completed**
Dates: **October, 1974 — July, 1975**
Cost: **Annual $2,846** **Projected Total $2,846**
RT Annual $2,846 **RT % of Annual Total 100%**
Annual Report Reference: **#12, Page 169, R-57**

OBJECTIVES:

1. To refine the means presently devised for measuring sugar in urine so that the method is not color-dependent.
2. To equip this device with a sonic output to make it useable by blind diabetics.
3. To construct the device so that it is simple to operate, has long-term reliability, and has a retail cost of less than $25.

METHODOLOGY:

1. Electrode material to complete the design of the unit was found which displayed no apparent corrosion or change in electrical properties under a 300% current overload.
2. This instrument to measure the current flow through urine and determine the electrical resistance of urine was tested under two conditions:
   a. synthetic diabetic urine in which glucose was artificially added to normal urine taken from normal subjects and
   b. diabetic urine: first from a single diabetic highly qualified to make measurements using the instrument over a period of three weeks and subsequently similar testing on 109 diabetic subjects.
3. The results of the test instrument were compared against the Beckman instrument, a direct enzyme-glucose analyzer using an enzyme oxidase reaction.

FINDINGS TO DATE:

1. Synthetic diabetic urine: the relationship between increased glucose in urine and current flow was an inverse linear relationship.
2. Diabetic urine of one subject: relationship between current flow and sugar in this diabetic was found not to be linear. The unit was then tested on 109 diabetics to see if one single good curve showing the relationship of glucose to current flow from which a reliable calibration of the instrument could be determined for each diabetic.
3. Diabetic urine of 109 subjects: the correlation was in the expected direction but not of sufficient value to allow accurate calibration of the test instrument. The correlation coefficient was −.317 which means that as the amount of glucose in urine increases, the current through the urine decreases, thus confirming initial laboratory tests. The correlation, however, was too low to allow accurate calibration for all subjects concerned. With a correlation coefficient of approximately −.3, there could be an error as high as 90% if some diabetic subjects used this instrument.

The instrument, therefore, would have to be calibrated individually for every user, not an economically feasible solution at this time.

APPLICABILITY: A large population of blind diabetics exists who could achieve full independence if a device were available to assist them in testing for sugar in the urine independently. The development of such a device is not a problem. More basic research along two lines is recommended: collection of more data on the basic chemical qualities of diabetic urine; and a large scale effort to gather long term data from individual diabetic patients. The first suggestion is basic research; the second is more engineering orienting. Both avenues should be followed in order to solve a very real problem for a very large population.

150 Effects of Specific Cutaneous Cold Stimulation on Motor Control in Cat and Man

Principal investigator:	Letbetter, W. D., Ph.D.	
1976		
Status:	Completed	
Dates:	October 1971-October 1974	
Cost:	Annual $5,930	Projected Total $20,000
	RT Annual $4,600	RT % of Annual Total 77.6%
Annual Report Reference:	#11, Page 80, R-49	

OBJECTIVES:

1. To provide a neurophysiologic rationale for the use of cold stimuli in rehabilitation medicine;
2. To clarify the basic mechanisms involved in specific cold stimuli upon motor control;
3. To determine the effect of cold stimuli on motor activity in the intact human using single motor unit techniques and then to employ the same specific cold stimulation method in animal preparations utilizing basic neurophysiologic techniques including intracellular recording to reveal neural mechanisms underlying the cold induced motor effects.

METHODOLOGY: Standard fine wire EMG techniques were used in the human studies. The animal studies were carried out on decerebrate cats in three phases: fine wire EMG studies, ventral root monosynaptic reflex studies, and intracellular studies of alpha motor neurons.

FINDINGS TO DATE:

Wolf, S. L., W. D. Letbetter, and J. V. Basmajian (1976). "Effects of a specific cutaneous cold stimulus on single motor unit activity of medial gastrocnemius muscle in man." **Amer. J. Phys. Med., 55,** 177-183.

The general findings suggest that motor outflow can be altered in muscle underlying a specific thermal (cold) stimulus and that the central excitatory state of the nervous system plays a large role in determining how cutaneous cooling information will be processed to affect motor changes.

Wolf, S. L. (1974). "The effect of a specific cutaneous cold stimulus on underlying gastrocnemius muscle motor activity." **Dissertation Abstracts International, 34,** #11.

With specific cooling of a skin surface, underlying muscular hyperactivity was decreased in decerebrate cats. The same general response was also true (although the response was transient in this case) in spinalized cats. Through intracellular recording from motor neurons and reflex recording from ventral roots, it was suggested that this cessation of motor activity was carried out through both presynaptic and postsynaptic inhibitory mechanisms. Changes in central states of excitability appear to regulate the level of excitability changes induced by the cold stimulus and may involve "flexor-reflex-afferent driven" interneurons.

Wolf, S. L. and W. D. Letbetter (1975). "Effect of skin cooling on spontaneous EMG activity in triceps surae of the decerebrate cat." **Brain Res., 91,** 151-155.

The effects of a specific cold stimulus to skin overlying a muscle were determined by analysis of single motor unit activity responses to these stimuli. Two different patterns of responses appear to be present: initial inhibition followed by a post-inhibitory excitation phase; and an initial excitatory response to the cold stimulus followed by inhibition without a post-inhibitory rebound response. It is felt that these two response patterns may reflect a differential behavior of two different motor unit types (i.e., fast and slow) within the motor unit pool for that muscle.

APPLICABILITY: These results may ultimately be applicable to rational design of cryotherapy regimens for specific types of neuromuscular hyperactive disorders by providing a basis for understanding the mechanisms through which cold stimuli exert their influence.

151 Spinal Muscular Tone of Scoliosis Patients in Siblings

Principal Investigator: J. V. Basmajian, M.D.
1976
Status: Completed
Dates: November 1971-June 1974
Cost: Annual $200 Projected Total $11,000
RT Annual $170 RT % of Annual Total 85%
Annual Report Reference: #11, Page 87, R-50

OBJECTIVE: To establish, using the indirect technique of muscle spindle stimulation, combined with EMG, whether patients with idiopathic scoliosis had muscle imbalance and whether their families showed a predisposition for this.

METHODOLOGY:

1. The subjects were families having one teenager with scoliosis.
2. All subjects, normal and scoliotic underwent the same procedure which is based on the concept that postural tone depends largely on the stretch reflex in extensor muscles.
3. Vibrators were applied to muscles to alter the stretch-contract reflex involving the muscle spindles, the primary afferents, and the homonymous alpha motoneurone. At frequencies of 100 Hz vibration is known to be a selective stimulus for the primary afferents making it an ideal tool for the study of postural stretch reflexes.
4. By employing the integrated value of the electromyograph from various parts of the scoliotic curve, the stretch sensitivities of the localized areas of muscle can be registered. This indicated the underlying imbalances and was of value with the siblings not presently manifesting scoliosis, especially if imbalances were shown in the families.
5. Four monopolar fine-wire electrodes were placed at critical points in the scoliotic curve and using high gain amplification and computer analysis of the integrated outputs, data was derived from the individual subjects during postures and movements with and without vibration.

FINDINGS TO DATE: Five normal volunteers and 24 scoliosis patients were tested. Hypersensitivity of the spindle reflex system was found on the concave side of the curve in 15 out of 23 thoracic curves. In the lumbar region the imbalance was less striking.

APPLICABILITY: Scoliosis is a major rehabilitation problem for young women; improved understanding of idopathic scoliosis, early diagnosis and therefore treatment, is provided.

152 Hormonal Agents in Myopathy

Principal Investigator: D. Rudman, M.D.
1976
Status: Continuing
Dates: June 1970-June 1975
Cost: Annual $65,204 Projected Total $8,000
RT Annual $1,774 RT % of Annual Total 2%
Annual Report Reference: #11, Page 32, R-14 and R-15

1977
Status: Continuing
Dates: June 1970-June 1980
Cost: Annual $65,204 Projected Total $16,000
RT Annual $1,774 RT % of Annual Total 2%
Annual Report Reference: #12, Page 27, R-14 and R-15

OBJECTIVES: To develop a method to detect the premyopathic stage of myotonic muscular dystrophy.

METHODOLOGY: The metabolic balance study technique was used to quantify responsiveness to the anabolic action of human growth hormone.

FINDINGS TO DATE: A previous study showed 4 men with myotonic muscular dystrophy (MMD) retained 3 to 10 times more N, P, K, Na and Cl than normal men in responses to 0.168 unit human growth hormone (HGH)/kg (body weight) 3/4/day. The present investigation aimed to learn if the trait of hyperresponsiveness to GH could be used to determine the premyopathic state of the disease. Subjects were 3 MMD parents and 16 of their offspring ("B" and "W" kindreds). Each individual was evaluated for clinical muscle disease (atrophy, weakness, myotonia), 3 conventional premyopathic indicators of MMD (cataract, depressed immunoglobulin G, myotonic discharges in the electromyogram), and hyperresponsiveness to HGH. Among the B and W offspring, 3 had "clinical muscle disease" (atrophy, weakness, myotonia), 4 had no clinical muscle disease but exhibited one or more of the indicators of premyopathic MMD, and 9 had neither clinical nor premyopathic abnormality. To investigate a sex difference in hyperresponsiveness to HGH which became apparent in the B and W families, the study was extended to include 11 adults with clinical MMD from other families.

Hyperresponsiveness to HGH was exhibited by all 9 males (age 19-52) with clinical MMD, and by all 3 male B and W offspring (age 28-34) who did not have clinical disease but who did show presence of a premyopathic indicator. In addition, of 8 male offspring without clinical or premyopathic abnormality, 5 (age 18-24) were hyperresponsive to the hormone. Three postmenopausal females with clinical disease were hyperresponsive. Contrastingly, four females with clinical MMD and one with the premyopathic stage, all of whom had normal menstrual function, were unresponsive to HGH.

In 7 males with clinical MMD, all of whom were hyperresponsive to HGH, the administration of 4 ug ethinyl estradiol/kg (body weight) 3/4/day simultaneously with HGH suppressed the anabolic reaction to the latter hormone.

These observations indicate that in the male carrying the MMD gene, hyperresponsiveness to HGH develops by age 18 and precedes the appearance of cataracts, depressed immunoglobulins, electromyographic myotonic discharges, or clinical atrophy and weakness. In the myopathic or premyopathic MMD female with normal menstrual function, hyperresponsiveness to HGH is not present, but after the menopause this characteristic becomes detectable. The sex difference probably results from inhibition of the anabolic response to exogenous HGH by endogenous estradiol in the female heterozygote with normal ovarian function.

APPLICABILITY: See above.

153 Heliomagnestat Study #3 – The Heliomagnestat (TM) in Pain: A Reinforcer in Contingency Management of Low Back Pain

Principal Investigator:	**S. F. Brena, M.D.**	
1977		
Status:	**Continuing**	
Dates:	**October, 1975-September, 1976**	
Cost:	**Annual $20,236**	**Projected Total $20,250**
	RT Annual $1,236	**RT % of Annual Total 6%**
Annual Report Reference:	**#12, Page 43, R-24**	

OBJECTIVES:

1. Evaluate a new device to determine its value in alleviating back pain

METHODOLOGY:

1. 50 low back patients to be evaluated according to Pain Clinic routine
2. Patients alternately treated with helio-magnestat three times per week for 6 weeks or with other methods.

FINDINGS TO DATE: Project never begun.

154 Heliomagnestat Study #4 – The Heliomagnestat (TM) in Back Pain: A Bio-Engineering Evaluation of Motor Performance During Treatment

Principal Investigator:	**S. B. Chyatte, M.D.**	
1977		
Status:	**Continuing**	
Dates:	**January, 1976-December, 1976**	
Cost:	**Annual $8,186**	**Projected Total $8,200**
	RT Annual $1,236	**RT % of Annual Total 15%**
Annual Report Reference:	**#12, Page 53, R-24**	

OBJECTIVES:

1. To objectively evaluate a new device for relief of pain.

METHODOLOGY:

1. 15 patients with low back pain will perform a bio-engineering task monitored on line to computer.
2. The device will be applied randomly with placebo instrument.
3. The motor performance change will be measured.

FINDINGS TO DATE: Project never begun.

155 Evaluation of Exercise After Myocardial Infarction National Exercise and Heart Disease Project (NEAHDP)

Principal Investigator:	C. A. Gilbert, M.D.	
1976		
Status:	Continuing	
Dates:	June 1972-May 1977	
Cost:	Annual $107,150	Projected Total $500,000
	RT Annual $1,150	RT % of Annual Total 1%
Annual Report Reference:	#11, Page 54, R-42	

1977
Status: **Continuing**
Dates: **June, 1972-May, 1977**
Cost: **Annual $105,000** **Projected Total $500,000**
RT Annual 0 **RT % of Annual Total 0**
Annual Report Reference: **#12, Page 65, R-42**

OBJECTIVES: To Determine in Patients with CHD:

1. The effects of the exercise program on cardiovascular response measured by electrocardiographic responses, heart rate and blood pressure, physical work capacity, myocardial energy requirements and systolic time intervals (STI).
2. The effect of the exercise program on social and vocational psychological adaptation.
3. The operational problems of a long-term physical activity program.
4. The effect of the exercise program on mortality rate, recurrent MI, occurrence of complications of CHD such as angina pectoris, dysrhythmia and congestive heart failure (CHF).
5. The prognostic implication and value of resting and exercise ECG abnormalities in patients with MI.
6. These behavioral and psychological characteristics which are important to adherence and non-adherence in long-term physical activity program.
7. The effect of different personality traits and social characteristics on psychosocial adjustment to an MI.
8. The effect on the level of plasma cholesterol and triglycerides.

METHODOLOGY:

1. Participants tested semiannually.
2. Each participant completes an informed consent, a cardiovascular history, physical exam, before each multistage exercise test (MSET).
3. MSET is graduated progressively, designed to indicate roughly the O_2 consumption of the patient at work and at rest.
4. Each stage is recorded as a 12 lead ECG with the XYZ scallar leads during the last 40 seconds of each stage.
5. MSETS begin with supine rest, STIS, and standing rest; exercises stages are completed with STIS and two supine recordings.
6. Written psychosocial measures to assess anxiety and depression levels are administered at various intervals.
7. Cholesterol and triglyceride levels are measured and analyzed annually.

FINDINGS TO DATE: As this study is a long-term and ongoing study, there has been no complete compilation of data by the Coordinating Center in Washington. At the conclusion of the project in 1980 a conference/symposium will be held to compile data results and decide on a dissemination plan for that data.

As of February 1, 1977, the Emory University Collaborating Center of the NEHDP had randomized 150 patients. The five collaborating centers of NEHDP have a total of 649 patients under study.

APPLICABILITY: If the basic objectives of the NEHDP are proven positive in the rehabilitation of MI victims the project could be of great benefit if introduced into the Vocational Rehabilitation Program of all states. Last year alone in the United States 29,270,000 Americans were stricken with some form of heart or blood vessel disease. Cooperation with the State Division of Vocational Rehabilitation in identifying potential clients for a program modeled after the NEHDP will be very important in returning patients to their prior productivity and useful place in the community.

156 Cognitive Assist in Motor Learning

Principal Investigator: Carmella Gonnella, Ph.D.

1976

Status: Continuing

Dates: January 1973-September 1975

Cost: Annual $18,246 — Projected Total $35,285.54
RT Annual $18,246 — RT % of Annual Total 100%

Annual Report Reference: #11, Page 64, R-45

1977

Status: **Continuing**

Dates: **January 1973-September 1976**

Cost: **Annual $14,045** — **Projected Total $49,300**
RT Annual $14,045 — **RT % of Annual Total 100%**

Annual Report Reference: **#12, Page 81, R-45**

OBJECTIVES:

1. To identify the parameters important in the learning of a motor activity by the patient;
2. to assess the relative influence of these parameters upon performance in the criterion task;
3. to report the distributional characteristics of the independent variables being measured;
4. to determine, during the primarily cognitive learning phase of skill acquisition, the effectiveness of audiovisual self instruction upon subsequent performance in the skill itself;
5. to assess the feasibility of this learning strategy in the general hospital environment;
6. to show that the method of sequential trials is an appropriate tool for the clinician interested in clinical research.

METHODOLOGY:

1. The rehabilitation skill to be learned is the three points crutch gait with one extremity non-weight bearing. The cognitive aspects of the skill are presented through a subject controlled audiovisual film simulation matched to the subject's sex and involved extremity. The testing of the effectiveness of the learning phase is through the performance of the skill without further instruction.
2. Selection of independent variables was based upon the nature of the sample, the nature of the instructional mode and of the criterion task, and the hypothesized influencing variables. Possible sources of extraneous variance presenting problems of internal and external validity were also considered.
3. The pre-experimental measures were selected to identify the subjects attentional intensity, optimum learning time, psychomotor status, and cognitive style and personal flexibility.
4. Performance in the motor task will be measured by: (1) cognitive recall of the components of the skill as presented audiovisually; (2) spatial temporal analysis of a subject's filmed crutch-gait sequence: (3) clinical rating of the subject's crutch gait performance.
5. Analytically, descriptive techniques, analysis of covariance multiple regression, and test for sequential trials will be used.

FINDINGS TO DATE: Project temporarily inactivated because of

1. delays in obtaining related equipment,
2. delays in obtaining appropriate patient sample.

Data collected thus far are being analyzed; and the design is being critically reviewed for modification which will be appropriate for the basic purpose of this study and which will expedite the completion of Phase III, Testing of Patients.

APPLICABILITY: A teaching learning model of a rehabilitation task under patient control will be available which can accelerate patient rehabilitation, saving costs to the patient and time for both patient and health practitioners. The results will also make available an alternative mode of patient teaching learning as an illustrative example in the allied health curricula and to current practitioners.

157 The Employment Potential of the Severely Disabled Young Adult

Principal Investigator:	**Samuel B. Chyatte, M.D.**	
1977		
Status:	**Continuing**	
Dates:	**August 1974-October 1976**	
Cost:	**Annual $31,056** **RT Annual $31,056**	**Projected Total $84,000** **RT % of Annual Total 100%**
Annual Report Reference:	**#12, Page 93, R-47**	

OBJECTIVES:

1. To assess a group of handicapped workers by various methods to determine job performance,
2. to compare these methods for accuracy,
3. to determine if workers skills were being appropriately used.

METHODOLOGY:

1. 18 Cerebral Palsy adults in a sheltered shop were evaluated.
2. MTM (Methods Time Measurement), AMA Impairment Rating and on-the-job performance was assessed.

FINDINGS TO DATE: MTM was much superior in assessing job performance than the AMA system which had almost no bearing on job performance.

APPLICABILITY: A more accurate system of assessing handicapped workers was demonstrated.

158 Improvement of Function of Spastic and Stroke Patients by Means of Biofeedback

Principal Investigator:	J. V. Basmajian, M.D.	
1976		
Status:	Continuing	
Dates:	August 1974-July 1977	
Cost:	Annual $45,234 RT Annual $80,000	Projected Total $300,000 RT % of Annual Total 35%
Annual Report Reference:	#11, Page 96, R-52	
1977		
Status:	**Continuing**	
Dates:	**August 1974-July 1978**	
Cost:	**Annual $54,186** **RT Annual $19,876**	**Projected Total $300,000** **RT % of Annual Total 35%**
Annual Report Reference:	**#12, Page 118, R-52**	

OBJECTIVES:

1. To perfect techniques of EMG biofeedback for the training of spastic patients to improve their functioning, thereby restoring them to gainful work;
2. to test the ability of spastic clients to relax an unused spastic limb;
3. to investigate whether learned relaxation can be maintained when stretch stimuli are applied;
4. to develop the learned controls in experimental conditions stimulating activities of daily living.

METHODOLOGY:

1. A hierarchy of training tasks of gradually increasing difficulty will be used.
2. Subjects will be trained to relax normal and then spastic muscles in the resting state.
3. This training in control of spasticity will be reinforced through the use of feedback while the subjects are being introduced to gradually more difficult and challenging task requirements, e.g., distracting noise, concurrent use of a contralateral limb, passive stretch of the spastic muscle being trained, or voluntary contraction of its synergist.

FINDINGS TO DATE:

1. A successful pilot project has been completed with 20 stroke patients. Preliminary analysis demonstrates the usefulness of the biofeedback technique for the recovery of control of foot drop in patients with hemiparesis. Three patients have been able to discard their braces. The others on biofeedback treatment have all markedly improved while the controls (those with physiotherapy only) exhibited a range from zero to moderate improvement. Both measured range of motion and strength of dorsiflexion averaged twice as great for the biofeedback group.
2. The initial stages of the formal study are presently underway. Normal subjects have been run under the training conditions to determine the best sites for EMG surface electrodes and to establish normal EMG activation patterns for each of the training situations. Some spastic subjects are already being run to determine the most reliable method for obtaining baseline measures of spastic function. In conjunction with this, computer controlled training programs are being designed and equipment is being modified.

APPLICABILITY: This is a direct new treatment of severely handicapped patients in types of cases previously "untreatable."

159 The Implications of the Socio-Cultural Background of Clients to Rehabilitational Personnel and Training

Co-Principal Investigator:	Nancy Kutner, Ph.D. and Carole E. Hill, Ph.D.	
1976		
Status:	New	
Dates:	September 1974-August 1976	
Cost:	Annual $28,109 RT Annual $27,109	Projected Total $60,000 RT % of Annual Total 98%
Annual Report Reference:	#11, Page 106, R-53	
1977		
Status:	**Continuing**	
Dates:	**September 1974-August 1976**	
Cost:	**Annual $22,817** **RT Annual $21,017**	**Projected Total $60,000** **RT % of Annual Total 92%**
Annual Report Reference:	**#12, Page 128, R-53**	

OBJECTIVES:

1. To determine factors influencing clients of varying ethnic and social backgrounds to assume particular attitudes toward disability;
2. to examine factors affecting the disabled individual's mode of reaction to disability and the subsequent incorporation of the disability into the individual's body image;
3. to examine varying definitions held by clients of different backgrounds concerning appropriate behavior by rehabilitation personnel.

METHODOLOGY:

1. Observation of rehabilitation clients and personnel at a large Metropolitan County Hospital in the Southeast.
2. Exploratory interviews with the rehabilitation clients.
3. Refinement of an interview schedule, utilizing insights from exploratory interviews.
4. Interviews, using the developed interview schedule, with clients in the physical rehabilitation ward, the renal unit, and the Cardiac Clinic of the hospital, and with clients at a small rehabilitation center located in a University medical complex.

The research was designed to explore a number of socio-demographic and social psychological factors having potential relevance for rehabilitation behavior, taking into account a wider range of disabilities than most previous studies.

FINDINGS TO DATE:

Three views of disability — clients' theories of causation, perceived losses attributed to disability, and perceived sources of improvement — were examined by race and sex. Although all subjects tended to see their impairment as result of God's will or fate primarily, only black males frequently blamed themselves for their impairment.

Losses attributed to disability seemed to be rather closely linked to sex role prescriptions in our society, although the losses associated with inability to perform task assignments — whether these are in the occupational sphere or inside the home — seemed most important to all clients.

White males seemed most ready to view themselves as active contributors to their own improvements; black females may be least ready to participate actively in rehabilitation, since they viewed both God and doctors as more important sources than themselves in helping them get better. These potentially different cultural attitudes should be recognized by rehabilitation personnel.

When future health outlook, as a measure of disability reaction, was investigated, no significant relationships were found to type or length of impairment; to clients' age, sex, or race; or to clients' locus of control scores, relation to significant others, or reactions of significant others to clients' problems. However, amount of help received from significant others did show some relation to health outlook. Clients who were receiving no help from significant others were most likely to be unsure or not hopeful about their future health, although the statistical difference between these clients and those who were receiving help from significant others was not significant. Perhaps clients' perceptions of rapport with, and acceptance by, significant others have less effect on clients' disability reaction than actual assistance which clients receive from significant others, i.e., actual interpersonal support.

APPLICABILITY:

1. It may be necessary for rehabilitation personnel to help individuals such as the black males in this study to work through their self-blame for their disability before successful rehabilitation can begin for these individuals.
2. Since losses associated with ability to work, both outside and inside the home, were especially emphasized by clients in this study, a need for extensive vocational rehabilitation seems high lighted.

160 Clinical Field Trials of the Emory Detachable Electric Powered Drive for the Standard Wheelchair

Principal Investigator:	Carmella Gonnella, Ph.D.	
1976		
Status:	New	
Dates:	August 1974-June 1975	
Cost:	Annual $11,585 RT Annual $10,085	Projected Total $11,585 RT % of Annual Total 91%
Annual Report Reference:	#11, Page 107, R-54	
1977		
Principal Investigator:	**Alfred Morris, Ph.D.**	
Status:	**Continuing**	
Dates:	**August 1974-June 1976**	
Cost:	**Annual $8,280** **RT Annual $7,360**	**Projected Total $19,865** **RT % of Annual Total 89%**
Annual Report Reference:	**#12, Page 138, R-54**	

OBJECTIVE: To measure the effectiveness of a detachable power unit for the standard wheelchair for patients with varying degrees of strength in the upper extremities and under a variety of conditions.

METHODOLOGY:

1. Three detachable power units will be constructed during a three-month period.
2. During a ten-month period the units will be tested for five months locally and for five months in three other RT Centers. A report of the testing will then be written.

3. During the test periods, the effectiveness in terms of propulsion of the detachable power unit and the standard chair will be assessed by both rehabilitation personnel and by patient-clients. Three types of measures will be used: a questionnaire of personnel and client observations, actual test performances, and sampling use of the wheelchair by clients over a three-month period.

FINDINGS TO DATE: Odometers attached to patient/client wheelchairs to determine miles traveled in their present chairs showed that a maximum of 13 miles per week with about 2.5 miles per work day. The Emory Detachable Unit has been found to do 10 miles on a single charge of the battery in initial testing. It also meets all criteria on climbing and descending inclines, turning radius, speed and ease of control.

APPLICABILITY: This unit will benefit a population of wheelchair users who could benefit from an easily detachable and attachable unit under their control that would convert a standard wheelchair into an electrical powered wheelchair. Advantages are: increased mobility because of the portability of the standard wheelchair; better use of a client's available energy; potentially less cost than the standard powered unit currently available.

161 Scientific and Clinical Testing of New Experimental Drugs

Principal Investigator	J. V. Basmajian M.D.	
1976		
Status	Continuing	
Dates	August 70-September 1975	
Cost:	Annual $45,460 RT Annual $460	Projected Total $150,000 RT % of Annual Total 1%
Annual Report Reference:	#11, Page 49, R-35	

OBJECTIVE: To evaluate the efficiency and safety of Lioresal (Ciba-Geigy), Lisseril (Merck, Sharp and Dohme), Tetrazepam (Robins) and U-28774 (Upjohn), in patients with muscle spasticity due to upper motor neuron disease, spinal cord disease, and spasmodic conditions in the back.

METHODOLOGY:

1. These studies are generally double-blind cross-over trials with a placebo preparation indistinguishable from the medication under study. They are not identified until the study is completed.
2. The experimental data on spasticity were derived from measurements of the patellar reflex force and associated myoelectrical activity in the activity in the quadriceps.
3. Specific determinations recorded at each session included integrated force and EMG values, two peak force values (minimum and maximum) and strength values.
4. The strength of the patient's lower limb was also determined in patients with some voluntary control of their lower limbs.
5. Under the controlled conditions of the experiment, changes in these values from one session to the next were taken to represent the patient's response to treatment.
6. The EMG and strength data were recorded and analyzed by the same method used in the reflex test with the exception that these data were analyzed over a longer period of time.

PROGRESS AND FINDINGS:

1. Lioresal Study (Ciba-Geigy): Of 26 patients who completed this study, Baclofen or BA 34647 proved to have a satisfactory effect on spinal spasticity in 14 patients. Clinically, these patients reported excellent improvement in their activity of daily living.
2. Lisseril Study (Merck, Sharp and Dohme): 105 patients have undergone comparison testing of Lisseril, a placebo, and Valium, a well-known muscle relaxant. Since this double-blind study is F.D.A. controlled no results may be given until all the data has been gathered and analyzed. It has been indicated by the primary investigators that there is substantial improvements in patients using Lisseril as compared to the placebo or Valium.
3. Tetrazepam Study (Robins): After five patients had been enrolled in this study, the company decided that they would withdraw all further investigations in all centers.
4. U 28774 Study (Upjohn): A pilot study of seven patients with post-stroke hemplegia was initiated. The drug proved to be both clinically and technically effective in treating spasticity.

APPLICABILITY: A part of the continuing search for effective treatments of a serious symptom of paralyzed people.

162 The Use of Motor Unit Potentials as a Measure of Neuromuscular Integrity

Principal Investigator: **S. L. Wolf, Ph.D.**
1977
Status: **New**
Dates: **September 1975-August 1976**
Cost: **Annual $38,452** **Projected Total $38,452**
RT Annual 99% **RT % of Annual Total 99%**
Annual Report Reference: **#12, Page 148, R-55**

OBJECTIVES:

1. Determine the motor unit distribution in an ulnar nerve innervated muscle (first dorsal interosseous) of the hand in normal subjects (quantifiable as the total number).
2. To make similar determinations in patients with disease processes of the central or peripheral nervous system (multiple sclerosis, muscular dystrophy, myasthenia gravis).
3. To evaluate the feasibility of motor unit determinations as a valid technique in assessing the neuromuscular status of patients.

METHODOLOGY: Determinations of the total number of motor units is a computer based process. We have developed silver recording electrodes which have been cut and molded to the configuration of the first dorsal interosseous muscle. The basis for the construction of these electrodes has been the muscle characteristics determined from cadaver material. We have updated our computer program so that not only can we determine the total number of motor units but also such characteristics as the latency (amount of time to record a response after stimulation of the nerve), the peak to peak amplitude of the response, the area of the motor unit potential responses, and the duration of the response. Obtaining these characteristics is important because, while the total number of motor units may not change in pathological conditions, any of the characteristics recording such responses may have changed and might indicate changes in peripheral nerve innervation of the first dorsal interosseous muscle.

FINDINGS TO DATE: Efforts have been concentrated on developing a computer program to interface with the equipment available. The computer program is almost complete, and we are now in the initial testing phase.

163 A Re-evaluation of Sensory Testing in Neurological Patients

Principal Investigator: **S. L. Wolf, Ph.D.**
1977
Status: **New**
Dates: **November 1975-November 1976**
Cost: **Annual $22,606** **Projected Total $22,606**
RT Annual $22,606 **RT % of Annual Total 100%**
Annual Report Reference: **#12, Page 157, R-56**

OBJECTIVES:

1. To determine the relationship between sensory conduction velocities (measured in meters per second) and the patient's objective perception of cutaneous sensation (measured in millimeters for pressure, millimeters for two-point discrimination, and milliamperes for electrical stimulation) in pathology affecting the peripheral nervous system.
    a. To compare sensibility in the normal and affected limb using the above measuring techniques.
    b. To compare sensibility in the affected limb before and after administration of the statement designed to change the attitude of the patient toward his perception.
    c. To compare values of these measurements over time.
2. To determine the facility with which this technique can be employed after teaching paramedical personnel to administer the procedure.

3. To determine whether the information generated from a data analysis is an assistance to physicians and vocational rehabilitation personnel in facilitating employment of the patient population.

METHODOLOGY: Patients report responses to pressure stimuli in the hand, to electrical stimulation, and to two-point discrimination stimuli in the finger and in the hand. These sensory thresholds are quantifiable. Patient populations have been restricted to individuals with peripheral nerve lesions (with or without surgical repair) and stroke patients. Post testing at each session follows the administration of a "sensatization statement." This statement is devised as a means of helping patients to develop an attitude toward the sensory testing experience. The statement contains no descriptors which help the patient to plan a strategy toward perception, but is designed to merely heighten his awareness of the stimuli. This additudinal variable is a take off from questionnaires and rating scales which have descriptors and have been described in various psychophysiological investigations.

FINDINGS TO DATE: To date 21 patients have completed the study. Of these 21 patients, 10 have had surgical repairs of the median or ulnar nerves, 8 have had compression or traumatic injuries of the median or ulnar nerve without surgical repair, and 3 have been stroke patients with stabilized sensory loss in an upper extremity. We have developed sensory profiles from the threshold measurements taken sequentially over a time span of one to fourteen months following injury. All patients have been returned to work, are receiving vocational rehabilitation, or are back in school. This project has thus far demonstrated that paramedical personnel, physicians, and vocational rehabilitation counselors can work in a cooperative, integrated and productive manner in returning patients with compromised hand sensation back to productive lives. The sensibility testing has proven to be a more sensitive index to return of sensations than conventional electrophysiological techniques such as sensory and motor conduction velocity measurements.

APPLICABILITY: This technique can be applied easily at a cost of less than $100. The success of the technique is contingent upon understanding of its application, and a cooperative effort between physicians, paramedical personnel, and rehabilitation counselors. The success of the technique, we believe, is contingent upon the patient playing an active role in his own evaluation. This philosophy differs considerably from the passive role the patient usually plays in the traditional electrophysiological measurements used to assess sensory and motor function in peripheral nerve injuries.

The procedure is being used at the Grady Memorial Hospital and at Emory University. We plan on developing this work into a rehabilitation utilization technique at Emory in cooperation with the Department of Plastic Surgery.

Rt7

Tufts University (RT-7)
Medical Rehabilitation Research and Training Center

CORE AREAS

Biomedical Engineering

Using modern technology to develop products for environmental modification and improved communication for persons with severe physical disabilities.

Consumer Involvement

Research into the state of the art and development of models for meaningful participation in the rehabilitation process by persons with disabilities.

Universe of Need/Patient Care

Activities which have resulted in the development of a computerized functional assessment and outcome evaluation system for medical rehabilitation facilities.

TUFTS UNIVERSITY

Carl V. Granger, M.D., Director
Tufts University Medical
Rehabilitation Research and Training Center
185 Harrison Avenue
Boston, Massachusetts 02111

PROJECT TITLES BY FY 1977 STATUS

COMPLETED	Abstract No.
Comparative Clinical Evaluation of Several EMG Processing Techniques (John Kreifeldt, Ph.D.)	164
Etiology, Prognosis, and Effects of Treatment in Bell's Palsy (Carl V. Granger, M.D.)	165
Community-Based Maintenance Care for the Long-Term Patient (Planning Grant to Develop a Model for Community-Based Maintenance Care for Aged and Disabled Patients) (Carl V. Granger, M.D.)	166
A Project to Provide Systematic Follow-Along to Persons Medically Rehabilitated in Fall River, Massachusetts (Carl V. Granger, M.D.)	167
Physiologic Responses of Hemiparetic Patients to Specific Exercise Stress (Theresa Hoskins, M.S.)	168
Engineering Analysis and Evaluation of a New Radial Palsy Splint (William J. Crochetiere, Ph.D.)	169
A Follow-Along Study of Clients Returned for Service to a State Rehabilitation Agency (Richard T. Goldberg, Ed.D.)	170
Consumer Advocacy Project (Harold S. Remmes, A.A.)	171
Establishment of Normal Standards of the SPOKES Test (Carl V. Granger, M.D.)	172
Predictor Feedback Technology for Electromyographic Control of Prosthetic and Orthotic Assistive Devices (John G. Kreifeldt, Ph.D.)	173

CONTINUING	
Functional, Social and Vocational Assessment of Surviving Persons with Documented Completed Stroke in the Boston University — Framingham Stroke Study (Glen E. Gresham, M.D.)	174
Black Language Studies (Hubert L. Gerstman, Ed.D.)	175
Homotransplantation of Total Hip Joint Articular Cartilage in Dogs (Mohinder A. Mital, M.D.)	176
Research in Upper and Lower Extremity Orthotics (James O'Leary, M.S.)	177
Electronically Aided Communication for the Severely Physically Disabled Non-Verbal (Richard A. Foulds, M.S.)	178
Follow-Along Study of a Medically Disabled Population in Fall River, Massachusetts: A Controlled Trial of Surveillance as a Means to Support Functional Independence (Carl V. Granger, M.D.)	179
Computer Retrieval of Data for Long Range Evaluation Studies of Medical Rehabilitation (Carl V. Granger, M.D.)	180

Statistical Collection System for a Medical Rehabilitation Facility (James F. Holzer, J.D.) 181

Computer Aided Motor Communication for the Severely Disabled Non-Vocal (Richard A. Foulds, M.S.) 182

Evaluation of the Feasibility of a Twelve Week Physiologically Paced Conditioning Program with Measures of Physiologic, Functional and Psychologic Factors in Hemiparetic Patients (Theresa Hoskins, M.S.) 183

Project to Document the Development of a Cooperative Group Residence for Severely Physically Disabled-Boston Center for Independent Living, Inc. (BCIL) (Paul Corcoran, M.D.) 184

Effective Training in Rehabilitation Medicine in New Medical School Curricula (Justus F. Lehmann, M.D.) 185

NEW

Auditory Feedback as it Relates to Language Acquisition and Utilization with the Severely Physically Disabled (Tufts-Talking-Typewriter-Trainer/T-T-T-T) **Annual Report Reference: #11, Page 159, R-58** .... **Approved (awaiting funding)**

DEFERRED 1977

Medical Examinations (Including Assessments) of a Selected Sample from the Study of Highland Heights, a Medically Oriented Housing Project for the Physically Impaired and Elderly in Fall River (Comprehensive Medical Examination of Experimentals and Controls in the Study for Independent Living at Highland Heights Apartments) (Sylvia Sherwood, Ph.D.) 186

DISCONTINUED 1977

Homotransplantation of Total Hip Joint Articular Cartilage in Dogs (Mohinder A. Mital, M.D.)

Nerve Conduction Studies as a Method of Differential Diagnosis of Neuropathies (Kamal B. Labib, M.D.) 187

Voice Activated Transducer for the Severely Physically Disabled (Richard A. Foulds, N.D.) 188

Brown University-VR-CHIP-RT-7 Program (Carl V. Granger, M.D.) 189

TRANSFERRED 1976

New England Spinal Cord Injury Foundation — Patient Registry (Carl V. Granger, M.D.)

PROPOSED

Feasibility Study of a Management Training Program for Severely Physically Disabled Persons (Bruce E. Marquis, M.A.)

The Effect of Home Modification on the Functional Performance of the Physically Handicapped (Paul J. Corcoran, M.D.)

Access to Careers in Science: A Feasibility Study to Establish Communication Linkages to Optimize Career Choices for the Severely Disabled Student in Higher Education (Martha Redden, Ed.D.)

164 Comparative Clinical Evaluation of Several EMG Processing Techniques

Principal Investigator: John Kreifeldt, Ph.D.

FY 1976
Status: Continuing
Dates: September, 1974-September, 1976
Cost: Annual $4,491 Projected Total $7,172
RT Annual $3,575 RT % of Annual Total 80%
Annual Report Reference: #10, Page 55, R-26

FY 1977
Status: Completed
Dates: September, 1974-September, 1976
Cost: Annual $7,267 Projected Total $7,844
RT Annual $4,247 RT % of Annual Total 58%
Annual Report Reference: #11, Page 127, R-26

OBJECTIVES: Several of the many nonlinear processors and processing techniques which now exist are being evaluated and ranked on a standardized basis, not only in terms of signal-to-noise characteristics, but also in terms of user effort and attention which must be employed. This is necessary since it is entirely feasible to design a processing technique with high signal-to-noise ratio but which for precision control demands more mental effort and attention than the user is capable of or which severely impairs attention to other matters.

From this research will be produced a standardized evaluation and comparison of EMG processors in terms of signal-to-noise ratios, ease of control, latest complete circuitries, and current costs for their fabrication, ease of installation and set up. Possible differences in rank orderings of the processors between normal and abnormal EMG activity will be determined as well.

METHODOLOGY: In order to meet the above objectives, nonlinear processors from our own research are being used and contact was made with other developers such as Childress to supply equipment and/or information from which to construct processors developed by them.

SIGNAL/NOISE EVALUATION

Samples of EMG activity are recorded on our special purpose tape recorders already existing to provide the standardized inputs for processing. These tape recorders are capable of recording from DC out to 2000 HZ, which is adequate for EMG. This will insure that each processor tested receives the identical input. The EMG activity is recorded from different body sites on normals.

CONTROLLABILITY EVALUATION

Ease of control is being determined through subjective ratings and objective measures. The objective measures come from outputs of a "critical tracking task." This task becomes increasingly difficult as time continues until such point that the subject can no longer control it. The "break down" point is a measure of the controllability of the system. Comparison of "breakdown points" for different processors allows rank ordering at least of the different systems evaluated.

FINDINGS TO DATE: Previous findings have been reported in Project No. 26. This project was dormant during a large portion of 1975-76. At the present time, work has been directed to equipment construction and computer programming preparatory to the evaluations. The findings should be available in 1-2 months and a paper is anticipated describing these for the 30th Annual Conference on Engineering in Medicine and Biology.

APPLICABILITY: This research will provide basic information of the type needed in order to attain the eventual goal of natural, multi-degree-of-freedom device control using EMG. The results will be useful as well for work physiologists and others who seek techniques for obtaining clear information on instantaneous muscle contraction for diagnostic or therapeutic reasons.

In addition, the standardized comparisons, to be published in monograph form, will make available for the first time important information otherwise inaccessible which will prevent much current duplication of effort with consequent savings in time and costs.

This work is anticipated to form a major part of the total methodology which combined with research from project 53 should form the basis for a novel and effective training/evaluation facility and approach. A larger grant is being prepared for this purpose.

165 Etiology, Prognosis, and Effects of Treatment in Bell's Palsy

Principal Investigator:	Carl V. Granger, M.D.	
FY 1976		
Status:	Completed	
Dates:	November, 1972-June, 1975	
Cost:	Annual $6,131	Projected Total –
	RT Annual –	RT % of Annual Total –
Annual Report Reference:	#10, Page 67, R-28	

OBJECTIVE: To test the hypotheses that electromyographic criteria are the most useful for the earliest projection of prognosis for spontaneous recovery in Bell's palsy, that medical treatment to reduce swelling in the facial canal or surgical decompression would permit patients who risk nerve degeneration to achieve more favorable degrees of recovery, and that the etiological agent, though unknown, may be viral.

METHODOLOGY: This is a collaborative study project involving the Departments of Physical and Rehabilitation Medicine, Neurology, Infectious Diseases, Otolaryngology, and Ophthalmology. Patients are hospitalized in the clinical study unit of the New England Medical Center Hospital if they are seen within 72 hours of the onset of the palsy. Investigation includes routine clinical evaluation plus electromyography and nerve stimulation studies, tests of salivary flow rate, galvanic testing of the vestibular nerve, taste tests, tests of lacrymal flow, stapedial reflex testing, assessment of hearing, lateral tomograms of the temporal bone, glucose tolerance tests, hematologic coagulation studies, and serum viral antibody studies. After baseline data is collected and a prognosis formulated, patients are offered no treatment if the prognosis is favorable, otherwise there is randomly assigned a high or low dose systemic steroid therapy. It is not anticipated that the numbers or disposition of patients will be such as to allow a statistically valid control group. Appropriate followups will be performed to correlate recovery outcomes with degree of risk for nerve degeneration and the type of treatment given.

FINDINGS TO DATE: A multispecialty collaborative project to investigate Bell's palsy was begun in January 1973. Etiology was explored with negative findings regarding viral antibody studies and hematologic investigations. Of the 35 patients studied, two (5.7%) had a clinical diagnosis of diabetes mellitus. This represented a higher prevalence than is represented in the general population.

Using electromyographic examination technique during the first 72 hours after onset, patients were selected for no treatment if prognosis appeared favorable or for prednisone treatment if there appeared to be risk of facial nerve degeneration. The criteria for the prognostic decision were based upon the numbers of facial muscles that retained voluntary motor unit activity as a result of the patient's effort to move the muscle. All patients for whom a favorable prognosis was projected improved early and completely. Of the 22 patients with a guarded prognosis and placed on prednisone treatment, 12 recovered early and completely, nine had delayed but adequate recoveries, and three failed to recover fully.

A follow-up examination was performed on 12 patients who were available and agreed to return at about two to three years after the onset. Repeat examinations showed no detectable ophthalmologic sequelae from the Bell's palsy. All patients demonstrated either normal or nearly normal facial muscle function. Only five patients had very slight to mild residual facial muscle synkinetic movement.

Of the remaining patients not identified as having diabetes mellitus, two of six patients treated with low dose prednisone had abnormal glucose tolerance curves, both initially and at follow-up. Of 16 patients treated with high-dose steroids, 13 had abnormal glucose tolerance curves initially. Six of these patients were seen for follow-up and five had normal glucose tolerance curves at that time while one still had an abnormal glucose tolerance curve.

Conclusions:

1. Early electromyographic monitoring is useful for identifying patients at risk of facial nerve degeneration from patients not at risk of facial nerve degeneration. Therefore functional prognosis can be estimated with a fair degree of certainty at three to four days after onset of the palsy.
2. There appears to be an association between diabetes mellitus and/or an abnormal glucose tolerance curve and Bell's palsy.

APPLICABILITY: Bell's palsy is a common affliction. Fortunately, the majority recover completely. However, a minority of patients have varying degrees of cosmetic and psychological handicaps as a result of the residuals of facial nerve degeneration. Presently unknown factors include etiology, precise recognition of those not destined to recover fully, and the specific treatment for those in risk of nerve degeneration.

166 Community-Based Maintenance Care for the Long-Term Patient (Planning Grant to Develop a Model for Community-Based Maintenance Care for Aged and Disabled Patients)

Principal Investigator:	Carl V. Granger, M.D.	
FY 1976		
Status:	Completed	
Dates:	September, 1972-December, 1974	
Cost:	Annual $6,724 RT Annual $974	Projected Total $3,179 RT % of Annual Total 14%
Annual Report Reference:	#10, Page 81, R-29	

OBJECTIVES: The study sought answers to the following questions:

1. Is it possible to make early prediction of the disabled who will require long-term, supplementary personal care in addition to conventional therapeutic and restorative care?
2. What variables are associated with the ultimate decision to place patients in either family settings or in institutional care, primarily focusing on the roles which family members play vis-a-vis social provision?
3. What is the volume and type of personal care attention which the severely disabled will require if they are to be maintained in normal family living circumstances?
4. What are the costs to the medical institution for prescribing and arranging social as well as medical follow-up?

METHODOLOGY: Using four collaborating rehabilitation institutions, admission data was secured on 297 patients. Ninety-six died, two-thirds of survivors were discharged home, and one-third were discharged to nursing homes. Of those returned home, 100 were in need of services and were monitored biweekly with telephone calls for six months. Using Tufts Long Range Evaluation Summaries and other forms, functional status data was collected at admission and discharge. Barthel index and PULSES scores were derived. Follow-up data were also collected. A stepwise multiple regression model was used to relate factors to whether a patient was returned home or discharged to a nursing home.

FINDINGS TO DATE: Forty-seven percent of patients who survived (N=173) were neurologically impaired with the youngest average age, 67 years. The oldest group, 80 years, was 15%. Average length of stay was shorter for those returned home than those discharged to nursing homes. The shortest length of stay was for musculoskeletal upper limb and spine disorders (without paralysis) of 1.2 months discharged home and the longest length of stay was for musculoskeletal lower limb disorders (usually hip fracture) discharged to nursing homes, 4.5 months.

Barthel admission and discharge scores were higher for patients discharged home, compared with those discharged to nursing homes. Even of patients discharged home, the Barthel admission and discharge scores were considerably lower in the neurological group than for other groups. Those patients who scored high on ability to fulfill self care and mobility needs and high ratings on families' willingness and capacity to provide care at a home plus families' and patients' financial ability to absorb home care costs combined to produce a reasonably strong correlation with return to the home setting.

At discharge ADL services were prescribed for 69 of 100 patients monitored for the post discharge study period. Relatives living in the household provided ADL services in 64 cases and community agencies were involved in 11 cases. Similarly with household, medical supervisory and escort services prescribed, family household members assumed the burden of care overwhelmingly.

For the [illegible]00 patients over the six month post-hospital discharge period, the average number of service utilization hours ranged from a high of 18.3 hours at the beginning to a low of 14.4 hours in the 20th week. It was calculated that the average cost of replicating the services during the first week was approximately $22.00. The mean number of hours for hospital staff to arrange post-discharge planning was 6.4 hours of staff time with a standard deviation of 4.6 hours.

APPLICABILITY: Gaps in the system of care exist for those who have completed intensive medical rehabilitation but are left without resources to sustain themselves at their optimal level of functioning in the community. Those unable to be independent in performing their own activities of daily living may be unnecessarily institutionalized. A relatively modest sum was the equivalent of the amount required to fill the prescription package of services. An insurance basis is to be considered for the home support of the long-term disabled with benefits payable on the basis of condition (severity of handicap). The hypothesis is advanced that significant simplification in and improvement of the social provision of care for social agencies can underpin and sustain the level of family care. Otherwise it appears that institutional care becomes a complete substitution for family care.

167 A Project to Provide Systematic Follow-Along to Persons Medically Rehabilitated in Fall River, Massachusetts

Principal Investigator:	Carl V. Granger, M.D.	
FY 1976		
Status:	Completed	
Dates:	February, 1973-June, 1975	
Cost:	Annual $6,504 RT Annual $2,554	Projected Total $5,589 RT % of Annual Total 39%
Annual Report Reference:	#10, Page 89, R-32	

OBJECTIVES:

1. To supply a regular system of surveillance to document levels of function and identify problems early in the population of patients discharged from the Rehabilitation Unit of the Hussey Hospital and the Stroke Unit of Union Hospital;
2. to reinforce the rehabilitation efforts of the two hospitals and provide an effective means for sustaining patients in their homes at their optimal levels of function.

METHODOLOGY: The rehabilitation personnel at the Hussey Rehabilitation Unit and at the Union Hospital Stroke Unit use programmed functional assessment formats for inpatients. A member of the Visiting Nurse Association staff attends the Hussey Hospital rehabilitation staff meetings and provides services to residents of the Highland Heights Apartments. This nurse has received orientation training at the Rehabilitation Institute in the specific rehabilitation techniques of nursing, physical therapy, occupational therapy, and orientation to the use of the outpatient/followup format for functional assessment. This nurse is to be responsible for gathering uniform data on all patients discharged from the Hussey Hospital Rehabilitation Unit and the Union Hospital Stroke Unit at intervals of 3-6 months. At the same time, she will identify new problems and be able to recommend services to meet identified needs. There will be justification of the provision of services over a prolonged period if this appears to be necessary to prevent or forestall institutionalization.

PROGRESS AND FINDINGS:

1. At the Union Stroke Unit, 164 patients were admitted and discharged from October 1972 to December 1973; 81 were discharged home; 21 went to long-term care facilities because it was judged that care was too extensive to be carried out at home and further rehabilitation potential did not exist; 21 died, and 33 were transferred to the Hussey Rehabilitation Unit because it was judged that further rehabilitation potential was present. Median Barthel Index Scores were computed for admission and discharge and were highest for those discharged home and intermediate for those transferred for further rehabilitation as compared with those patients who died or were discharged to long-term care facilities.
2. At the Hussey Rehabilitation Unit, 28 patients of the 33 transferred were discharged by December 1973. While the admission Barthel scores were roughly similar, those 14 patients discharged home proved to have greater potential for improvement as compared with the lower scores of the 10 patients discharged to long-term care facilities and the 4 patients discharged to acute hospitals.

3. Of the 237 patients admitted and discharged from the Hussey Rehabilitation Unit between October 1972 and December 1973, 14 different major handicapping conditions are represented. However, 85% of the population is made up of local cerebral conditions, lower limb amputations and lower limb musculoskeletal conditions. Overall there is indication that higher admission and discharge Barthel scores are associated with discharge home as compared with other outcomes. Patients discharged to Highland Heights were in the next level of Barthel scores on admission and discharge.

APPLICABILITY: To serve patients successfully discharged, the rehabilitation unit of a hospital needs to extend its responsibilities through a systematic followup and follow-along program. Acquisition of followup data in a standardized format provides a basis for evaluation of the rehabilitation program and should permit the facility to serve its patients better over the long run.

168 Physiologic Responses of Hemiparetic Patients to Specific Exercise Stress

Principal Investigator:	Theresa Hoskins, M.S.	
FY 1976		
Status:	Completed	
Dates:	January, 1973-December, 1974	
Cost:	Annual $6,096 RT Annual $5,930	Projected Total $6,077 RT % of Annual Total 97%
Annual Report Reference:	#10, Page 109, R-33	

OBJECTIVES:

1. To define the realistic limitations to exercise tolerance in hemiparetic patients;
2. to elucidate metabolic and cardio pulmonary responses to known exercise loads to compare these responses of hemiparetics to those of matched normals, and to determine the causes of restricted walking speeds and the higher energy costs of activity;
3. to provide a rationale for determining therapeutic programs designed to improve performance capacity in hemiparetic patients.

METHODOLOGY:

1. Thirteen hemiparetic patients from the Rehabilitation Institute of the Tufts New England Medical Center were selected on the basis of the following criteria: the ability to ambulate independently with or without assistive devices; the confirmation of a stable medical status; and the lack of cardiac involvement or the stabilization of a cardiac condition which allows unrestricted physical activity.
2. A hemiplegic patient was shown the bicycle ergometer and was assisted in mounting it in order that adjustments could be made in seat height and seat position. The patient practiced pedaling to experience how it felt. He then dismounted and rested lying down for 30 minutes. Measurements were taken during the 25-30 minutes to determine the basal metabolic condition.
3. The first exercise bout was done on the stationary bicycle pedaling at 40-60 rpm for 5 minutes at a set exercise intensity of 25 watts. During minutes 4-5, measurements were taken to determine physiologic adjustments to this exercise intensity. The patient tested for 10 minutes in seated position. From the 7-10 minute, measurements were taken to determine recovery values.
4. The second exercise bout was done on the bicycle again pedalling at 40-60 rpm for 5 minutes at a set exercise intensity of 50 watts. The bicycle was electronically controlled to maintain a constant resistance regardless of the pedalling speed. Again, measurements were taken during the last minute of exercise. The patient rested for 10 minutes and recovery values were taken.
5. The parameters measured included heart rate, blood pressure, respiratory rate, oxygen consumption, carbon dioxide production, minute ventilation and tidal volume.
6. Seven age-matched normal females were recruited from the hospital worker population to serve as a control group. None of these control subjects were engaged in an exercise program. All control subjects performed the identical bicycle exercise protocol as performed by patients, and simulated a one sided weakness during exercise.

FINDINGS TO DATE: Ventilatory function in the hemiplegic group and the control subjects was comparable at rest but in heavier exercise, a marked inefficiency was noted in the patient group. The patient's respiratory rate was higher while the tidal volume was lower resulting in a comparable total minute volume to the normals, but much more work of breathing and an increase in the physiologic dead space in the lungs, thus making ventilation less efficient for gas exchange.

Patients tended to have higher resting heart rates, and higher heart rate responses to each exercise than normals. In addition, their post exercise resting heart rates were consistently higher than their own initial basal heart rates, thus did not return to baseline as did the normals. Therefore patients did not experience full recovery in the time they were measured. Both systolic and diastolic blood pressures were more elevated in the patient group, both at rest and in exercise.

The predicted maximal oxygen uptake for the female patients was compared to the control group value, and for the male patients was compared to the 2 separate published norms on age-matched males. Both patient groups were well below the normals in aerobic capacity. All of these findings represent inefficient cardio-vascular and pulmonary responses to exercise demands.

Therefore the limitations to exercise tolerance in hemiparetic patients appear to be potentially reversible, and related to poor aerobic capacity, or low physical fitness.

APPLICABILITY: Knowledge of the metabolic adaptations in hemiparetics can provide a rationale for determining therapeutic programs designed to improve performance capacity in hemiplegic patients. It can further provide assistance to vocational counselors and paramedical personnel in determining appropriate job placements relative to physiological tolerance for work.

169 Engineering Analysis and Evaluation of a New Radial Palsy Splint

Principal Investigator: William J. Crochetiere, Ph.D.
FY 1976
Status: Completed
Dates: November, 1973-July, 1975
Cost: Annual $1,300 Projected Total $1,424 (RT)
RT Annual $244 RT % of Annual Total 19%
Annual Report Reference: #10, Page 153, R-39

OBJECTIVE: The new design for the radial palsy splint will be analyzed both theoretically and in the clinic to determine its principle of operation and to optimize its usefulness for individual patients with radial nerve palsy.

METHODOLOGY: Preliminary observations suggest that the splint-hand combination operates as a kinematic four bar linkage. The initial stage of this project will involve the mathematical modeling of the dynamic system to determine the functions of the innervated musculature on the operation of the splinted hand. The results of this theoretical analysis will be evaluated in the clinic by the application of the above derived specifications to individual patients with radial nerve palsy. Criteria for its effectiveness will include increased functional abilities and patient acceptance.

FINDINGS TO DATE: The anatomy and kinesiology of the hand has been studied with emphasis placed upon the muscles which are innervated by the radial nerve. Two approaches have been studied for providing the missing prehensile function in hand muscles affected by radial nerve palsy. In one approach the wrist is stabilized in the functional position of 30° extension, and suspension of the fingers at the proximal phalanges is provided by an elastic restoring force. In the second design, the hand is rigidly suspended at two points: the wrist and the proximal phalanges of the four fingers. The splint is designed so that the weight of the hand which is concentrated between the two supports causes the hand to assume an extended position. An analysis of the function of both splints was made assuming the hand and splint combination to be a rigid linkage with concentrated masses and no frictional losses. The results show that the work required to close the hand with the second splint is about 70% of that required to close the hand with the first splint.

APPLICABILITY: Present designs of splints to support the wrist and fingers are clumsy from the functional point of view. Use of splints of more effective design would reduce the disability imposed by radial nerve palsy until spontaneous recovery occurred or else definite corrective surgery was proposed.

170 A Follow-Along Study of Clients Returned for Service to a State Rehabilitation Agency

Principal Investigator:	Richard T. Goldberg, Ed.D.	
FY 1976		
Status:	Completed	
Dates:	November, 1973-June, 1975	
Cost:	Annual $7,849 RT Annual $169	Projected Total $6,668 (RT) RT % of Annual Total 2%
Annual Report Reference:	#10, Page 179, R-41	

OBJECTIVES:

1. To determine the reasons for re-opening of clients for service after having been rendered rehabilitation services and closed;
2. to describe those factors associated with clients who are returned for service to state vocational rehabilitation agencies;
3. to correlate the medical and vocational adjustment factors associated with return for service.

METHODOLOGY:

1. A random sample of 107 clients was selected from nine area offices of the Massachusetts Rehabilitation Commission. This was a 20% sample of all cases re-opened for service during fiscal years 1971 and 1972. The sample was stratified by disability group and rehabilitation status. One-third of the sample was comprised of clients having a primary disability of mental illness or mental retardation and two-thirds of the sample had a primary physical disability. Rehabilitation status was stratified in two groups: those rehabilitated within a 36 month period prior to re-opening and those not rehabilitated within a similar period.
2. Data was collected from the case records and 300 closed case reports to determine prior status and reasons for re-opening the case. Each client selected was given a vocational interview and the medical surveillance scale developed by the Tuft's University Research and Training Center. The Vocational interview was coded by two independent judges, and inter-rater reliability was obtained at the 0.01 level. The medical surveillance scale requires the interviewer to observe the functional abilities and limitations of the client and to record his observations on a check list. The vocational and medical ratings were ordered from low to high on each category and intercorrelated. Demographic data taken from the case records were also submitted for intercorrelations with the vocational and medical ratings.

FINDINGS TO DATE:

1. An analysis has been made of case record material of the 107 clients chosen for the sample and an equal number of clients chosen on a substitute basis for the purpose of ascertaining disability, reason for return for services, and the nature of the services provided.
2. Fifty clients of the 107 chosen for the sample have been interviewed to date, and contacts via letter have been made with the remaining clients to be interviewed.
3. Preliminary coding is being carried out by two part-time coders.
4. The primary area of investigation for the follow-along study has been to understand the reasons clients return for services to a state vocational rehabilitation agency. The most frequently mentioned response was for physical restoration services; most of the responses were made by clients having a sensory or orthopedic disability. The second most frequently mentioned response was employment. The next most frequently mentioned response was that the client did not remember the reason for his return for service or reported having only the original contact with the Commission. Another frequently mentioned response was for college training. Two responses regarded on-the-job training. The remaining responses were counseling, financial assistance, and mental restoration services.
5. Former clients (107) of the Massachusetts Rehabilitation Commission were evaluated to determine the reasons for their return to the Commission a second time. Clients returned to obtain physical restoration services, employment or training such as in a vocational school or college. Clients were given a vocational interview (the Goldberg Scale of Vocational Development) and the Tufts Programmed Functional Assessment, embracing the Barthel and PULSES Profile. Work status at follow up was significantly predicted by the Goldberg Scale and the PULSES Profile. A significant number returned to work after receiving services a second time.

APPLICABILITY: Possible implications from this study would be early identification of clients needing continuing services and a reduction in the number of re-opened cases. The provisions of follow-along services would also minimize the additional time and expense associated with re-opening a case.

171 Consumer Advocacy Project

Principal Investigator:	Harold S. Remmes, A.A.	
FY 1976		
Status:	Continuing	
Dates:	June, 1972-October, 1975	
Cost:	Annual $12,465 RT Annual $11,505	Projected Total $32,777 (RT) RT % of Annual Total 92%
Annual Report Reference:	#10, Page 229, R-50	
FY 1977		
Status:	**Completed**	
Dates:	**June, 1972-October, 1976**	
Cost:	**Annual $15,466** **RT Annual $12,931**	**Projected Total $45,708** **RT % of Annual Total 84%**
Annual Report Reference:	**#11, Page 181, R-50**	

OBJECTIVES:

1. To help consumers see themselves as a cohesive group(s) with multiple interests to be served for the betterment of themselves and society in general;
2. to help existing consumer groups understand the advantages of cross-categorial consortiums in order to gain needed change;
3. to bring more consumers into and through the rehabilitation project;
4. to use the resources of the consumer group(s) to help improve the quality of the rehabilitation process itself.

METHODOLOGY:

1. By way of mailed questionnaires, information has been solicited to identify all existing consumer groups (including membership, structure, purposes, etc.), regardless of purpose on a national survey basis. The products of this research are the **Consumer's Guide to Organizing the Handicapped, A Directory of Organizations of the Handicapped in the United States,** and a "state of the art" document to describe similarities, differences, and unresolved problems as they currently exist within consumer organizations.
2. The three documents above will provide the data base for utilizing available information in order to make consumers more aware of their roles in improving their own rehabilitation.
3. In order to ascertain whether or not maximal use is being made of the **Consumer's Guide to Organizing the Handicapped,** a questionnaire has been developed and sent to organizations in order to determine the degree to which the document has been useful in their organization and planning.
4. In addition to a central meeting, meetings would be held in specific geographic areas to discuss the consumer and rehabilitation.

FINDINGS TO DATE:

1. The publication **A Consumer's Guide to Organizing the Handicapped** has been developed and published.
2. Data collection regarding organizations of the handicapped has been completed and will be included in a "state of the art" document soon to be published.
3. **A Directory of Organizations of the Handicapped in the United States** has been completed and published. This directory is currently being widely distributed.
4. An unexpected outgrowth of this project has been interest indicated in it by both consumers and professionals alike resulting in meetings and speeches by project personnel.
5. Further, as a result of the project's advocacy role, the nucleus for a National Coalition of the Handicapped has met and begun the organizational process.
6. A new perspective has been added to the RT-7 Council by the inclusion of consumer input.
7. The Massachusetts Council of Organizations of the Handicapped has become far more sophisticated from its involvement with the RT Center.

APPLICABILITY: By creating a better understanding of the limitations of the Massachusetts Council of Organizations of the Handicapped, the methods of securing individual service, and the ways in which an organization can assist the client, it is the hope of the project that more persons will receive better rehabilitation.

172 Establishment of Normal Standards of the SPOKES Test

Principal Investigator:	Carl V. Granger, M.D.	
FY 1976		
Status:	Completed	
Dates:	January, 1974-June, 1975	
Cost:	Annual $1,868	Projected Total –
	RT Annual –	RT % of Annual Total –
Annual Report Reference:	#10, Page 235, R-51	

OBJECTIVES: To evaluate a simple, problem-solving exercise that would serve as an objective screening method for patients who may or may not have overt neurologic disturbances and would serve as a gauge of change for patients undergoing rehabilitation treatment.

METHODOLOGY: Normal subjects were surveyed and classified according to: age group, occupational category, sex, preferred handedness, educational level and use of eyeglasses. The test was administered in a proscribed manner.

FINDINGS TO DATE: Age was the only factor that significantly affected the duration of time to complete the SPOKES test. Three separate age groupings were identified: 15-44, 45-60, 61 plus.

APPLICABILITY: A table of normative data was developed. The SPOKES test has been incorporated into Perceptual-Motor Test Battery administered by the Occupational Therapy Service. The test yields a simple means for serial comparison of problem-solving ability where deficits exist in eye-hand coordination, immediate memory, attention span, shifting thought patterns and sequences, visual scanning and figure-ground discrimination.

173 Predictor Feedback Technology for Electromyographic Control of Prosthetic and Orthotic Assistive Devices

Principal Investigator:	John G. Kreifeldt, Ph.D.	
FY 1976		
Status:	Completed	
Dates:	September, 1974-September, 1976	
Cost:	Annual $3,333	Projected Total $4,834 (RT)
	RT Annual $2,417	RT % of Annual Total 73%
Annual Report Reference:	#10, Page 253, R-53	

OBJECTIVES: The objectives of the project are to determine the suitability of predictor biofeedback philosophy and technology as a means of achieving flexible and natural control of EMG assistive devices. Specifically, the suitability of this technique to achieve natural and accurate proportional control over two single degrees-of-freedom has been determined. Since this technique has merit, follow-up studies should be directed toward the best manner of implementation of the technique and its potential for multiple degree-of-freedom control.

METHODOLOGY: Prediction technology is based upon the feedback to the user of both present and predicted (extrapolated) behavior of the system. In order to meet the stated objectives the following approach was used.

1. The best manner of obtaining the extrapolated behavior was determined. Several possible techniques exist – Taylor series expansion of the instantaneous output; the use of a model of the controlled system which can be updated rapidly and run in "fast-time" were two potential candidates. These and others were reviewed and a choice made on the basis of implementation feasibility and fidelity of the predicted information. Each method has its own merits and disadvantages for particular problems.
2. Analog computer simulations were made of realistic devices. The dynamic response of a single degree-of-freedom system (the "Boston Arm") was obtained to serve as a model of a realistic EMG proportional control device. These dynamics were then simulated on analog computers.

3. The "device" was controlled with and without predictor feedback under optimal conditions by normal subjects using EMG activity. A comparison was made of system controllability with and without prediction feedback by normal subjects using EMG activity detected by surface electrodes. Various amounts of "smoothing" were used.

   Comparisons were based on objective criteria such as accuracy and speed of the device's controlled response and on subjective evaluations by the users when comparing the predictor-no predictor control. Standardized tasks were used as much as possible to facilitate comparisons with other potential philosophies of control which might develop. Visual display feedback was used since this seems at present an optimal sensory modality for information. If the predictor philosophy has negligible advantages in the optimal feedback case, it is unlikely that it would be different for less optimal feedback display methods.

FINDINGS TO DATE: The use of predictor feedback technology is demonstrated to be a powerful means for improving simultaneous independent EMG control of two axes of a simulated orthotic/prosthetic device. Large decreases in task completion time and errors and increases in simultaneous control were achieved using predictor information feedback under EMG control. Work on this concept is being continued particularly with attention to its use as a training aid and as an information feedback concept in other areas of rehabilitation.

Results using simultaneous electromyographic EMG activity to control multiaxial assistive devices, in the past, have been very (1) disappointing. A past study showed EMG to be unacceptable in controlling a two axis orthotic assist device without additional information feedback to the person.

Feedback studies have thus far centered around providing the user with information regarding the device's instantaneous behavior, concentrating on aspects of sensory modality to be used. Kreifeldt (2) recently suggested that in addition to this instantaneous behavior, predicted device behavior should also be assessed for improving EMG control and supplanting the feedback lost from paralysis for amputation. The predictor concept has proven very successful in improving controllability in other man/machine systems.

This paper describes a recent study investigating predictive feedback as a suitable means for improving simultaneous multiaxial EMG control involved. Six subjects participated in a CRT simulated 2-dimensional self-paced task. Each dimension used model dynamics based on a commercial prosthetic arm. Three spans of path predictions were tested as a form of visual feedback against 2 values of filter smoothing time constant.

Subjects were instructed to move across as quickly as possible with the least amount of errors through a maze of randomly oriented gates to a final circle. EMG signals from the biceps and triceps of each arm controlled the X and Y positions of the cross. These signals were detected using Beckman surface electrodes and the resulting EMG activity was differentially amplified, full wave rectified and smoothed with different time constants.

Figure 1 shows task completion time versus the different combinations of prediction spans and smoothing with and without EMG.

The following results are apparent:

1. EMG control with the predictor feedback resulted in substantially reduced task completion time (on the order of 100% ($p < .05$)).
2. Task completion time is independent of the amount of filter smoothing where using predictor feedback. When no predictor information feedback is used, task completion time increased by 40% when the time constant was doubled.
3. Manual control with a joystick input and no predictor feedback was inferior to EMG control with predictor feedback.
4. Using predictor feedback substantially reduces the variance in performance. In fact some subjects could not complete the task at all without this feedback whereas everyone successfully completed the task with predictor feedback.
5. Other analyses showed that simultaneous control is increased by 60% when using predictor feedback.

   Several conclusions follow from these results. The controllability of the system is greatly enhanced without any degradation in signal-to-noise ratio. In fact an inherently sluggish system (high SNR) is as controllable as a responsive (low SNR) one. Performance variability is greatly reduced permitting pre-evaluations. These and other results and conclusions will be presented.

The findings have been presented in Conference at the 1976 29th Annual Conference on Engineering in Medicine and Biology. Briefly — the predictor methodology appears to hold great potential for increasing controllability of EMG controlled devices in a natural way. Our research in this area suggests that this predictor feedback concept should also be of great value for training users of EMG controlled devices.

A formal paper is being prepared for publication.

APPLICABILITY: The work described provides basic information on a new approach to information feedback for EMG control of assistive devices for the disabled. The goal of natural, proportional control of a single or multiple degree-of-freedom device is much closer. In addition, a basic methodology has been laid for simultaneous natural, proportional control of multiple degrees-of-freedom devices from several EMG activity sites.

The application of predictor technology to EMG control also cuts through the apparent inpass of the smoothing-sluggishness relationship which governs simple EMG signal processing by utilizing this relationship as a beneficial rather than detrimental subsystem characteristic.

The use of predictive biofeedback as applied in this research also indicates a great potential for training users of EMG devices so that this type of feedback can perhaps be withdrawn as training progresses. It should also be possible to use this concept for retraining of muscular control function.

The potential of this research (project 53 and 26) seem so favorable that a larger grant application is being prepared for larger scale implementation and testing.

REFERENCES

1. Kadefors, R., Taylor, C.J.M.: "On the feasibility of Myo-Electric Control of Multifunctional Orthoses." Scand. J. Rehab. Med. 5:134-146, 1973.

2. Kreifeldt, J., Yao, S.: "A Signal-to-Noise Investigation of Nonlinear Electromyographic Processors." **IEEE Transactions on Bio-Medical Engr.** 2:4, 1974

174 Functional, Social and Vocational Assessment of Surviving Persons with Documented Completed Stroke in the Boston University — Framingham Stroke Study

Principal Investigator:	Glen E. Gresham, M.D.	
FY 1976		
Status:	Continuing	
Dates:	November, 1971-October, 1976	
Cost:	Annual $19,033 RT Annual $15,901	Projected Total $103,209 RT % of Annual Total 79%
Annual Report Reference:	#10, Page 23, R-16	
FY 1977		
Status:	**Continuing**	
Dates:	**November, 1971-October, 1976**	
Cost:	**Annual $26,880** **RT Annual $18,516**	**Projected Total $106,634** **RT % of Annual Total 69%**
Annual Report Reference:	**#11, Page 21, R-16**	

OBJECTIVES:

1. To delineate the magnitude and distribution of various kinds of disability in long-term survivors of stroke in the Framingham Heart Study.
2. To compare these frequencies with those for the same kinds of disability in controls, matched for age and sex, to determine better the amount of disability specifically related to stroke.
3. To examine, through statistical analysis, the respective roles of neurologic deficit, comorbid disease, environmental, and psychosocial factors in producing long-term disability in stroke survivors.

METHODOLOGY:

1. The case intake period for this study was April 1, 1972 through March 30, 1975. During this period, every living member of the original Framingham Study cohort (5,209 persons), who had survived a documented completed stroke, was identified. Of 155 eligible subjects, 148 were successfully studied for a completion rate of 95%.
2. Stroke-free control subjects from the same cohort, matched for age and sex, were also identified and evaluated in an identical manner.
3. All cases of documented completed stroke were verified by a neurologist from the Framingham Study team.
4. All functional assessments were performed by the study nurse investigator, Therese F. Phillips, using a standardized data collection instrument. Specific types of disability studied were in the areas of activities of daily living, mobility, vocational function, socialization, use of outside transportation and institutionalization.
5. Functional assessments were performed 6 or more months after the most recent stroke to reduce the effects of changing neurologic status.
6. For statistical analysis, the data from functional assessments were combined with those from the regular medical and neurologic evaluations by the Framingham Study staff.

FINDINGS TO DATE:

1. Of the 148 total stroke survivors, 66 were men and 82 were women. 76 per cent were age 65 or greater. Etiologically, 75 per cent of the strokes were attributed to athero-thrombotic brain infarction (ABI). 86 per cent of the survivors had sustained only one stroke. There were no survivors of more than 3 strokes.
2. As already published (Gresham, GE, Fitzpatrick, TE, Wolf, PA et al: Residual Disability in Survivors of Stroke — The Framingham Study. **New England Journal of Medicine 293:**954-956, Nov. 6, 1975), the frequencies of institutionalization, dependence in self care and mobility, decreased vocational function, and decreased socialization outside the home were significantly greater in the stroke groups, as compared to the control group.
3. Subsequent data analysis has produced similar findings for socialization inside the home, decrease in interests and hobbies, and decreased ability to use outside transportation.
4. Comorbid diseases related to hypertension and generalized arteriosclerosis were more prevalent in the stroke group; other diseases showed no significant difference.
5. The emerging pattern of stroke disability in long term survivors is as follows: The prevalence of institutionalization is low and dependence in ADL and mobility are seen in 32 and 22 per cent of the survivors, respectively. Occurrence rates greater than 1 out of 3 are seen only for types of disability where cognitive function, psychosocial variables and environmental factors (as opposed to physical dysfunction alone) are likely to play a significant role.

APPLICABILITY: The findings of this study provide unique and useful data for the estimation of risk for long term disability (as opposed to mortality) in stroke and the expected community prevalence of such disability by type. From this, better prognosis for function can be made in the individual stroke patient and planning for health and rehabilitative services for stroke survivors can be done on a more rational basis.

175 Black Language Studies

Principal Investigator:	Hubert L. Gerstman, Ed.D.	
FY 1976		
Status:	Continuing	
Dates:	September, 1972-August, 1975	
Cost:	Annual $7,008 RT Annual $1,346	Projected Total $8,947 RT % of Annual Total 19%
Annual Report Reference:	#10, Page 31, R-19	

OBJECTIVE: To determine whether typical semantics in the black community as well as the typical phonetic and phonemic usage are consistent with the stimulus words used in the standardized Peabody Picture Vocabulary Test (PPVT).

METHODOLOGY:

1. This study reversed the procedure and requested that the child name each of the four pictures on the stimulus cards rather than pointing to the pictures of the one stimulus as is done on the standardized test. An analysis of the words, as recorded by clinicians and screeners, demonstrates the effect of utilization of words and sounds as a confounding factor in language screening and examination as exemplified by the PPVT.
2. Subjects included black children in the private and parochial school systems of the Boston Model Cities Neighborhood between the ages of 4 years 3 months, and 9 years 5 months. An equal number of white children who met the same criteria will be used as a control group.

FINDINGS TO DATE: Ninety children, thirty each from Black Inner City (BIC), White Inner City (WIC) and White Middle Class (WMC) school populations within the Greater Boston area, were selected as subjects for a study utilizing the Peabody Picture Vocabulary Test (Form A), and Elicited Word (naming) Responses with an Adapted Series of PPVT Plates.

The study sought to discern whether Black children were a "different" population with regard to the standardized PPVT, and if so, whether the difference was attributable to phonemic and/or semantic usage.

The analysis of data indicates that the null hypothesis of this study cannot be rejected. There is no statistically significant difference between Black children and those of the general population with regard to the stimulus words and plates utilized in the PPVT. A trend towards difference was seen, but significance was not established. The Black Inner City children (BIC) tended to score lower in general than the White Inner City children (WIC), who in turn tended to score lower in general than the White Middle Class children (WMC). However, in examining the response errors on items beginning from Plate 57, the BIC group appeared to be a different population at a level of significance greater than .001. Through that level (Plates 1 through 56) they did not appear as a "different" population, and there was no difference among the three groups. The PPVT assumes a basal of 50 (Plate #) for ages 7-9 to 9-5 years. Our responses support the assumed basal for all groups tested.

The alternate hypothesis — that there is a difference between Black children and children in the general population with regard to phonemic and/or semantic usage and that because of this difference, the Black children do not understand the stimulus words and plates utilized in the PPVT, was not supported.

Regarding the Correlary Questions

There was no significant item-error consistency on test items both within or between groups, nor was there any significant difference in the naming responses within or between groups. If a difference does exist, it appears to be lexical, i.e. vocabulary, as opposed to phonemic and/or semantic, i.e. conceptual. Most of the BIC group gave evidence of in-class or concept naming ability suggesting that their incorrect receptive responses are probably related to experience which does not give access to some of the PPVT vocabulary. (See Table D)

What the PPVT seems to measure of the Inner City child is a lack of advantage in that Inner city children (White and more so with Black children) will tend to score below their chronological age level and below their potential as indicated by in-class naming responses. Additional research possibilities suggested as a result of this investigation are:

1. Organization of the PPVT Plates and Stimulus Words according to their descending frequency of occurrence, using Oral Word Lists, e.g. Howes (1966), as criteria
2. Organization of PPVT Plates and Stimulus Words in order of descending frequency of occurrence using "written" word lists such as **The Teacher's Wordbook of 30,000 Words,** Thorndike-Lorge (1943), or other updated word list studies.
3. Repetition of this study adapted to other tests of receptive vocabulary (e.g. Ammons).
4. Repetition of this study with Black Middle Class subjects.

APPLICABILITY: It is possible that lack of understanding of specific urban and ethnic language usage retards the rehabilitation of persons in various communities and that such a lack of understanding leads to vocationally handicapping situations that could be avoided by early efforts at bridging such a gap if it exists.

176 Homotransplantation of Total Hip Joint Articular Cartilage in Dogs

Principal Investigator:	Mohinder A. Mital, M.D.	
FY 1976		
Status:	Continuing	
Dates:	October, 1971-December, 1975	
Cost:	Annual $166 RT Annual —	Projected Total $14,921 RT % of Annual Total —
Annual Report Reference:	#10, Page 37, R-23	
FY 1977		
Status:	**Discontinued**	
Dates:	**October, 1971-December, 1975**	
Cost:	**Annual** **RT Annual**	**Projected Total** **RT % of Annual Total**
Annual Report Reference:	**N/A**	

OBJECTIVES: The proposed animal work is intended to answer, on the basis of tissue-typing and long-term survival experiments, whether it would be justifiable to carry on the transplantation procedure in humans with any degree of predictability of success. Results to date have indicated that cartilage is weakly antigenic and displays a delayed immunologic response. This work should provide an answer to whether the problem can be overcome with relatively simple measures or not.

METHODOLOGY: A fairly pure, inbred lot of (beagle) dogs to be used with paired, and to some extent, serum matched animals for donor and recipient. From donor, one hip studied for developing a method for storage in a viable state as judged by metabolic activity of the cell and ability to take up radioactive S35.

The donor graft then grafted onto recipient dog after technique developed at the University of Strathclyde. Tools for procedure (costing about $2,000) donated to Dr. Mital by the University of Strathclyde to help continue work on the problem.

Dogs allowed to recover and thereafter allowed complete freedom of activity on a farm. From time to time radiographic evaluation of hips to be done. Non-operated hips to act as controls for comparison.

In some animals, angiographic studies to be done to evaluate vasculature in the hip region and radioisotope S35 to be injected so as to label the cartilage cells. Animals sacrificed at set intervals to establish, as far as possible, the histological phenomena in these closely related tissue matched dogs as opposed to what we already know for animals not matched in any way except for size.

Endpoint of experiment will occur if it becomes apparent that by this type of breed and tissue matching technique, the last hurdle in path of making clinical trial justifiable can be overcome, and that grafting is successful in all respects.

If delayed immunological response met, then in collaboration with Dr. Paul Russell of Massachusetts General Hospital, proposal to give short course of immuno-suppressive drugs to see if such procedure could help overcome problem.

If still unsuccessful, then at least all various factors, namely chemical, mechanical, and biological explained, and lack of feasibility of such procedure positively delineated on basis of current state of knowledge in field, and total spectrum of histological response.

FINDINGS TO DATE: No activity was conducted during the 1973-74 grant year due to the loss of research space at the Boston City Hospital and research technician support. In late 1974, approval was received to utilize the unexpended funds to support a laboratory assistant and set up a new laboratory.

The laboratory set up was begun during FY 1976 in space provided by the Joseph Kennedy, Jr. Memorial Hospital for Children. A research assistant was employed and tooling up was begun.

APPLICABILITY: Rheumatoid arthritis is one of the major causes of joint destruction and consequent crippling in relatively young patients. Therefore, the project, if successful, will have a tremendous practical application in patients whose joints have been destroyed by disease and for whom no artificial joints available today are entirely successful.

177 Research in Upper and Lower Extremity Orthotics

Principal Investigator:	James O'Leary, M.S.	
FY 1976		
Status:	Continuing	
Dates:	January, 1971-October, 1977	
Cost:	Annual $19,860 RT Annual $12,414	Projected Total $64,624 RT % of Annual Total 63%
Annual Report Reference:	#10, Page 41, R-24	
FY 1977		
Status:	**Continuing**	
Dates:	**January, 1971-October, 1977**	
Cost:	**Annual $26,912** **RT Annual $13,127**	**Projected Total $66,050** **RT % of Annual Total 49%**
Annual Report Reference:	**#11, Page 117, R-24**	

OBJECTIVE: To investigate methods of manufacture which will make light weight orthotics more readily available.

METHODOLOGY: Experience in experimentally fabricating orthoses indicates that the process of forming from plastic sheets is relatively easy to master as a task. It does, however, require a significant investment in training time to master these skills.

Improvements are being sought in fabrication methods and design of these devices which will reduce the initial cost of gaining lightweight orthotics capability. The vacuum forming process reduces the learning effort required, but commercially available equipment for this process is expensive. Development of an inexpensive vacuum forming system to be used in an orthotist's work area has been a primary step in this project.

A system which meets these needs was designed earlier in this project and is currently in use in nine locations. This usage is being evaluated for possible problems or areas where improvement could be obtained.

Further effort is required in the area of orthotic design that utilizes the properties of polypropylene. The use of the vacuum forming system in the fabrication of orthoses other than the ankle-foot device is presently being investigated.

FINDINGS TO DATE: The work described here is directly aimed at making an improved device available to a larger group of patients.

The research in upper and lower extremity orthotics relates to several research objectives spelled out in Area N, "Rehabilitation Engineering," of the RSA FY-1977 Research and Evaluation Strategy. The project has already developed a class of devices that are "more cosmetic, lighter in weight, and less expensive." A very productive approach is being demonstrated both for "stimulating industry in the development, production and marketing of equipment required by the severely disabled" and for cooperating "with State agencies for vocational rehabilitation in developing systems of information exchange and coordination to promote the prompt utilization of engineering developments."

The project has concentrated on the effort to develop more effective utilization of vacuum forming systems through the inclusion of other orthotic and orthopedic devices as possible products from such a system. Work has progressed on the plastic knee brace, as well as a variety of long leg orthoses.

The design of the existing vacuum forming system has stabilized. This unit has been described in various publications. Units built by the BMEC have been provided to Moss Rehabilitation Hospital, The Veteran's Administration, and RT-3 at the University of Washington at Seattle. A fourth unit has been provided to the University of Washington for use in their project in South America. Certain design changes may result from reports from these locations.

The design of a large sized vacuum forming table which can accept molds the size of wheelchair parts has been completed. Technology similar to the smaller table will be used in order to make this a cost effective device. Construction will be accomplished during the summer of 1977.

178 Electronically Aided Communication for the Severely Physically Disabled Non-Vocal

FY 1976

Status:	Continuing	
Dates:	November, 1972-October, 1976	
Cost:	Annual $46,856 RT Annual $16,587	Projected Total $53,000 RT % of Annual Total 35%
Annual Report Reference:	#10, Page 45, R-25	

Principal Investigator: **Richard A. Foulds, M.S.**

FY 1977

Status:	**Continuing**	
Dates:	**November, 1972-October, 1979**	
Cost:	**Annual $55,591** **RT Annual $26,215**	**Projected Total $141,273** **RT % of Annual Total 47%**
Annual Report Reference:	**#11, Page 121, R-25**	

OBJECTIVES:

1. Seek out successful utilization of the Tufts Interactive Communicator in both the Vocational Rehabilitation and Special Education departments of the New England states.
2. Identify additional needs of the non-vocal population and develop alternative man-machine interfaces.
3. Conduct a regional survey to identify the population of non-vocal individuals, their communication needs, and the existing services available to them.
4. Communicate with all centers using communication equipment developed by RT-7 and follow-up on the clients using the devices.
5. Communicate with other researchers in the field of non-vocal communication and share experiences and results.

METHODOLOGY:

1. Identification of potential users in special needs programs and the training of local staff in the operation of the TIC.
2. Follow-up and possible relocation of the ten devices placed under a similar program during 1975. (Items 2 and 3 utilize the reporting forms developed during 1975. The reader is referenced to Project 25 of the 1974-75 Annual Progress Report of RT-7 for these forms).
3. Design of a less sophisticated communicator which displays symbols rather than orthographic characters (The Symbol TIC or SymTIC) based upon requirements of six special needs classroom teachers. These six locations are to be provided with a device.
4. Develop a more powerful communicator which includes word and sentence processing, and more flexible editing.
5. Develop a new interface that will take advantage of the more controllable hand control exhibited by many severely involved cerebral palsied individuals. This will follow the readily available literature on lapboard or letterboard design.

FINDINGS TO DATE: Much of the work done during the past year has been devoted to the expansion of the Utilization Program. A continuation grant from the Massachusetts Department of Education has allowed the placement of six additional Tufts Interactive Communicators, as well as the installation of seven Symbol Communicators. This now brings the total of TIC's in the Massachusetts School System to a total of 16. Other TIC's have been placed through agreements with the Veteran's Administration and various agencies. A total of 24 TIC's are in use outside of Massachusetts.

Two new designs are presently active. The use of an elastomeric keyboard has provided a tactile input system that can emulate any conventional letter or word board and provide both electronic and printed output.

The second new project is the design of a programmable tape recorder. The combination of a commercially available tape transport and an Intersil 6100 microprocessor will offer an inexpensive system that can store up to 100 prerecorded messages on a tape cassette. The unit will be accessed by a tactile keyboard (described above) or a scanned keyboard (similar to the Symbol TIC). The output will be human speech and can consist of any length messages. Access time for the worst case will be under four seconds.

The availability of a simple speech system will make the educational process using Bliss Symbolics, or Rebus Symbols much more flexible. The cost of such a device will be considerably less than a voice synthesizer (see project 58) and will present much more pleasing utterances. It will, however, not be as flexible as a synthesizer. The use of this type of system will be investigated in the vocational rehabilitation process.

APPLICABILITY: Learning is very slow for children with communication problems, even in the special education classroom. The development of such a system promises to accelerate this pace and to provide a dynamic interaction between teacher and student which is necessary for effective teaching. Such a system will free the class teacher from individual drill work and allow more time for creative lesson planning or specialized instruction.

179 Follow-Along Study of a Medically Disabled Population in Fall River, Massachusetts: A Controlled Trial of Surveillance as a Means to Support Functional Independence

Principal Investigator:	Carl V. Granger, M.D.	
FY 1976		
Status:	Continuing	
Dates:	November, 1973-June, 1977	
Cost:	Annual $20,075 RT Annual $18,215	Projected Total $62,545 (RT) RT % of Annual Total 91%
Annual Report Reference:	#10, Page 131, R-35	
FY 1977		
Status:	**Continuing**	
Dates:	**November, 1973-June, 1977**	
Cost:	**Annual $22,683** **RT Annual $17,136**	**Projected Total $60,399 (RT)** **RT % of Annual Total 76%**
Annual Report Reference:	**#11, Page 35, R-35**	

OBJECTIVES:

1. To determine if follow-along of patients discharged from a hospital rehabilitation unit who are under the surveillance of case aids can reduce the number and severity of acute medical care incidents or hospitalizations and/or chronic institutionalizations;
2. to test whether periodic objective and comprehensive assessment of functional capacity in these patients provides a practical measurement of outcome and/or provides a useful indicator of sustained capacity and maintenance care needs of rehabilitation patients.

METHODOLOGY:

1. The study group will consist of patients discharged from rehabilitation treatment and evaluation programs in the greater Fall River area during the 18-month period following the beginning of the study. The study group will be stratified on the basis of a five category diagnostic procedure. Each member of the study group upon discharge from the rehabilitation treatment program will be randomly allocated to one of three groups of about 75 patients.
2. Group I will be kept in contact by case aides who will note any change in functional capacity subsequent to discharge. Changes will be evaluated by a professional rehabilitation team which, in addition, will evaluate the group upon admission to and discharge from the rehabilitation program and at 6 and 12 months after discharge. Appropriate rehabilitation steps will be taken on the basis of those evaluations.
3. All members of groups 2 and 3 will be evaluated by a professional rehabilitation team upon admission to and discharge from the rehabilitation program, at 6 months after discharge (for group 2 only) and at 12 months after discharge. Appropriate rehabilitation steps will be taken on the basis of each evaluation.
4. Measurements of the functional life status and quality of life status will be taken of each member of all three groups on admission, discharge, and one year after discharge. Outcome measures pertaining to hospitalization, instutitionalization, medical status, and medical care services will also be obtained for all members of the three groups for the one year period following discharge. The Programmed Summary of Functional Status (PSFS) and a Quality of Life Measures will be used.

FINDINGS TO DATE: A joint program in rehabilitation research has been established between the Tufts Rehabilitation Institute and the Hussey Hospital in Fall River. The PSFS has been applied on 150 patients in the Fall River area with satisfactory results. A social interview is being developed. This will include quality of life measures previously developed and utilized in a number of other research studies. Arrangements are being made with the Home Health Agency of Fall River for the services of the case aides who will provide the follow-along intervention surveillance.

Of the first 120 rehabilitation patients released into the community, 42 members have been randomly allocated to Group I (those who receive the six month rehabilitation nurse evaluation), and 38 have been randomly allocated into Group III (those who only receive the pre- and post-measures).

APPLICABILITY: There is a great need for the development of a program to evaluate the follow-along approach to the care of chronic rehabilitation patients as well as more efficient medical care delivery with fiscal containment. This program is concerned with both areas as well as the development of more specific information on the functional assessment of patients.

180 Computer Retrieval of Data for Long Range Evaluation Studies of Medical Rehabilitation

Principal Investigator:	Carl V. Granger, M.D.	
FY 1976		
Status:	Continuing	
Dates:	November, 1973-October, 1978	
Cost:	Annual $51,119	Projected Total $150,409
	RT Annual $29,238	RT % of Annual Total 57%
Annual Report Reference:	#10, Page 139, R-36	
FY 1977		
Status:	**Continuing**	
Dates:	**November, 1973-October, 1978**	
Cost:	**Annual $71,162**	**Projected Total $191,264 (RT)**
	RT Annual $50,429	**RT % of Annual Total 71%**
Annual Report Reference:	**#11, Page 43, R-36**	

OBJECTIVES:

1. Ability to compare outcome of patients who have undergone rehabilitation and are being maintained in a rehabilitated status for the purpose of evaluating program effectiveness.
2. Ability to track patients through various programs of care.
3. Ability to judge "degree of severity" of disability by more objective data.
4. Ability to approximately predict rehabilitation outcomes based upon nature and severity of disability.

METHODOLOGY: A set of programmed examination formats has been designed which incorporate elements of the Programmed Summary of Functional Status (PSFS) plus basic demographic identification data (i.e. name, birth date, sex, marital status, address, household constellation, etc.) and functional data items such as active motion of the limbs, self-care, mobility, verbal speech and visual ability, intellectual and emotional adaptability, competence of the family unit, financial ability, and educational or vocational ability. The worksheets comprise a series called Long-Range Evaluation Summary (LRES) and are mostly check-list items with space provided for free text. The check-list items are derived from definitions that establish mutually exclusive categories with regard to the independence or dependence of the individual being assessed. Provision for free text enables clinicians to express information not sufficiently describable by check-lists.

FINDINGS TO DATE:

1. A methodology has been conceptualized and brought to the stage of computer application in direct support of clinical care for on-stream acquisition and display of functional assessment data for purposes of describing patient status at various times during medical rehabilitative care.
2. The method is reliable and valid and is easily used by providers of care.
3. Various adaptations of the method have been applied to different patient care settings and to studies of different populations of the handicapped.
4. Techniques for data feedback to providers are established.
5. A training program for potential users of the system has been developed.
6. Publications have been produced describing the state-of-the-art.

APPLICABILITY: This project has lead to refinements in determination of suitable outcome criteria for medical rehabilitation and toward development of better predictors of rehabilitation success. It is expected that the method will be applicable to other centers serving patients undergoing medical rehabilitation as well as to state vocational rehabilitation agencies for identifying and tracking progress made by the severely disabled.

181 Statistical Collection System for a Medical Rehabilitation Facility

Principal Investigator:	**James F. Holzer, J.D.**	
FY 1977		
Status:	**Continuing**	
Dates:	**November, 1973-October, 1976**	
Cost:	**Annual $8,654** **RT Annual $4,877**	**Projected Total $15,282 (RT)** **RT % of Annual Total 56%**
Annual Report Reference:	**#11, Page 55, R-40**	

OBJECTIVES: To initially develop a statistical collection and reporting system as a basis for comprehensive administrative reports designed to evaluate the effectiveness of the program operation, outcomes and cost control.

To utilize and review the established reporting system in the day to day operation and administration of the Rehabilitation Institute and related programs therein.

To initiate refinements of the reporting system based upon practical use of the statistical data, and to identify any incident problems in the collection and dissemination of this data.

METHODOLOOGY: Procedures for designing a statistical reporting system within a medical rehabilitation facility is primarily based on experience and prior knowledge of the types of questions which must be asked about program operations and the services rendered. Such questions will identify what information must be collected, how often, how specific, and how the information will be used.

At the onset of the project, it was determined what specific information was to be collected and for what purpose. After this was established, a special intake form was designed to collect this needed information concerning inpatients, outpatients, consultations both internally and outside of the New England Medical Center, inpatient and outpatient statistics relative to electrodiagnostic testing (EMG), and outpatient data relative to increased activity in the cardiac rehabilitation program. As the project developed, other related forms were designed to collect certain information in a more efficient manner.

Next, computer applications were developed and utilized on a gradual and preliminary basis. This was initially begun by coding the intake forms to facilitate key punch operations, EDP programs and programmable typewriters. This information with appropriate computer codes was stored on programmable typewriter tapes. Currently, data collected on inpatient programs and ancillary therapy services has been transferred to a computerized system.

It was the initial intent of this research project to develop a statistical reporting system capable of answering the questions listed below. Through the course of the project, the listing was refined and is described in the RT-7 Annual Progress Report for 1975-76 under "Current Year's Activity, Progress and Findings to Date."

FINDINGS TO DATE: With proper planning and adequate staffing, it is possible for every rehabilitation health service provider to maintain a comprehensive statistical data base to assist in the administrative review, program planning and budget analysis of the operation. In spite of careful planning however, it is difficult to develop one statistical collection form that can be efficiently applied to all service areas of an active acute rehabilitation medical care facility. Although a major resource form such as the "Statistics of Clinical Activities" form can be applied in the majority of service areas, abbreviated statistical registers for service areas with a high volume of patient activity will have to be developed in the interest of providing good medical care. Statistics, appropriate analysis and procedures for developing a statistical collection system must be actively shared with all agencies, hospitals, and organizations interested in maintaining effective monitoring and control of a priority health service.

The average length of stay for patients being treated at the Rehabilitation Institute for less than 90 days is 25.2 days for 1975, a decrease of 7.8 days over 1974. The average length of stay for the same category for calendar years 1973, 1974 and 1975 is 30.93 days. The average length of stay for patients sampled in 1975 who remained at the Rehabilitation Institute for over 90 days was 111 days, a decrease of 44 days.

The daily cost of providing rehabilitation care for patients sampled in all length of stay categories has increased. The significant factor in the increase results from a larger daily room and board rate. This is due to the increased cost of nursing service personnel, and the general overhead costs of operating a comprehensive acute rehabilitation facility in a large metropolitan area. The daily medical charges as well as the cost of physical and occupational therapy are the next biggest factors in cost of rehabilitation services.

However, it is significant to note that the declining length of stay offsets the increases in daily cost, and has resulted in the average total cost of rehabilitation decreasing slightly.

It also must be noted however that it is very difficult to predict the patient mix at any given time, thereby making length of stay a variable and fluctuating factor in rehabilitation facilities.

APPLICABILITY: Due to rapidly increasing cost of providing quality health care in America today, numerous government and private agencies are developing procedures by which the services and the cost effectiveness of providing those services will be closely monitored and reviewed. In addition, federal legislation to develop health systems agencies (HSA), as well as regulations for peer review mechanisms have been formally enacted. Needless to say, the development and implementation of a systematic tabulation and review of statistical data is applicable not only to justify the need for rehabilitation services in this country, but to provide valuable input into the actual development of these criteria by the monitoring agencies. Therefore a uniform statistical collection system and a procedure to evaluate this data is relevant to medical rehabilitation, and indeed, may be a determining factor in justifying the need and benefits of physical and vocational rehabilitation as a whole, and its future role in this country's health care industry.

182 Computer Aided Motor Communication for the Severely Disabled Non-Vocal

Principal Investigator:	Richard A. Foulds, M.S.	
FY 1976		
Status:	Continuing	
Dates:	November, 1973-October, 1978	
Cost:	Annual $36,023 RT Annual $35,677	Projected Total $77,316 RT % of Annual Total 99%
Annual Report Reference:	#10, Page 191, R-44	
FY 1977		
Status:	**Continuing**	
Dates:	**November, 1973-October, 1977**	
Cost:	**Annual $43,428** **RT Annual $37,474**	**Projected Total $116,587** **RT % of Annual Total 86%**
Annual Report Reference:	**#11, Page 143, R-44**	

OBJECTIVES: The research will be directed towards maximizing the motor communication rate of the severely disabled non-vocal person through the use of a high speed digital computer. Several noncomputerized communicators have been developed in recent years which interpret "yes" – "no" commands and allow the motivated client to communicate at a rate of up to 12 words per minute. This is well below the speed of an average typist (approximately 55 words per minute) and far below the rate of human speech which can exceed 200 words per minute. The relatively slow rate of those communicators can result in extreme frustration on the part of a user with normal intelligence.

METHODOLOGY:

1. Develop a computer software package which will anticipate the redundant information in a message and thereby increase the motor communication rate. The computer software package will reside in a large general purpose digital computer (most likely the DEC System 10 at Tufts University) and will be accessed over the telephone lines. Program evaluation will be performed on a cathode ray tube (CRT) display terminal.
2. Do exploratory studies on normal individuals interacting with the "intelligent" communicator to establish its utility. A baseline for motor communication rates will also be established at this time.
3. Once the programmable communicator is functional, it will be introduced into the special education classroom for use. Progress of the students in their reading and writing abilities will be assessed both before and after the introduction of "intelligent" communicator to indicate their progress.

Based upon the exploratory studies, a prototype communicator will be developed which will be integrated into a clinical setting. Tests will be performed to determine the increase in communication output rate (if any) and to identify difficulties in the man-machine interface. These difficulties will become the focus of future design efforts.

FINDINGS TO DATE: The concept of anticipatory scanning based upon statistical information has offered ideal typing improvement since the early analysis of the data. The engineering effort has been aimed toward developing the appropriate human-machine interface and the hardware development necessary to put a device into a clinical testing situation.

The major accomplishment of this past year has been to refine the concept of a dynamically scanned keyboard that was introduced in the RT-7 Annual Report for 1975-76.

This system not only reduces the amount of time required to output a message, but also reduces the amount of physical effort required to make that output.

Each of the two dynamic characters will require only a single switch signal. Since they potentially represent 75-80% of the choices, there will be a reduction of 35-40% of physical effort. The typing rate is improved by nearly 40% depending upon the message.

APPLICABILITY: The development of an "intelligent" communicator which can increase the motor communication rate of a severely disabled non-vocal individual should have a profound effect on all his social encounters. Among other things, it may allow a more valid assessment of the intelligence of such an individual by bypassing his motor disability.

The importance of effective communication in rehabilitation cannot be overstressed. The need for a means of expressing desires and feelings is one that must be satisfied in all people regardless of their disability. The importance of this project is that it will allow a person to perform at the highest level of his ability. As described in the introduction to the Biomedical Engineering core-area of research, this project is consistent with RSA research objectives in Research and Evaluation Area "N", Rehabilitation Engineering.

183 Evaluation of the Feasibility of a Twelve Week Physiologically Paced Conditioning Program with Measures of Physiologic, Functional and Psychologic Factors in Hemiparetic Patients

Principal Investigator:	**Theresa Hoskins, M.S.**	
FY 1977		
Status:	**Continuing**	
Dates:	**November, 1974-September, 1977**	
Cost:	**Annual $15,447** **RT Annual $13,086**	**Projected Total $38,789** **RT % of Annual Total 85%**
Annual Report Reference:	**#11, Page 229, R-57**	

OBJECTIVES:

1. To demonstrate the feasibility of having hemiparetic patients participate in a 12 week physiologically paced conditioning program.
2. To identify factors which interfere with the completion of the 12 week conditioning program.

3. To obtain measures of physical, psychological, functional, physiological variables prior to, during, and at the end of the 12 week conditioning program to determine if there is a relationship among any of them and between each of them to compliance with the program.

METHODOLOGY:

1. Hemiplegics who were discharged from the Rehabilitation Institute, who were screened by the physician in charge of out patients for exercise testing were recruited for pre testing. Criteria for admission to the program were: at least 6 months after CVA with complete medical stability, lack of symptoms of cardiac disease especially during exercise stress test, neuromuscular function at a plateau, and motivation to participate in a conditioning program for 12 weeks.
2. The exercise pre test included physiologic measures during two 5 minute sessions of submaximal bicycle exercise on an ergometer. Measures during steady state included: EKG, heart rate, blood pressure, respiratory rate, tidal volume, minute ventilation, and oxygen uptake. On the basis of the patient's response to this test, a decision about the safety of entering the program was made, and an exercise prescription assigned.
3. Psychological variables were measured for self concept variables, using the Social Vocabulary Index and the Tennessee Self Concept Scale.
4. Functional variables were measured: ability to climb and descend stairs, ability to walk 50 yards on level, ability to comb hair with affected arm, ability to tie shoe laces with two hands, ability to write name, interview to obtain Barthel Score.
5. A regular schedule of exercise over 12 weeks, 3 days each week, for 1/2 hour of stationary bicycle exercise under supervision was instituted. Progression of training was made via increasing the work load, and decreasing the resting phase on an interval schedule of pedaling. Each patient was progressed according to his own tolerance, limitations and exercise prescription.
6. Each session records were kept of resting heart rate blood pressure, submaximal exercise heart rate response, submaximal exercise blood pressure response, work load used for each submaximal exercise, exercise to rest time ratio. After 6 weeks and again at 12 weeks ventilatory function in response to exercise and oxygen uptake at submaximal exercise were taken. Also at these points, self concept variables and functional changes were recorded.

FINDINGS TO DATE: Five females and three males have completed 12 weeks of bicycle exercises on a three day per week, thirty minute session schedule. Two of three males adhered faithfully and enjoyed the program, but the third man missed frequently, was depressed throughout. All but one female finished the 12 week program, and she terminated her program for personal inconvenience reasons after 8 weeks. The remainder of the females enjoyed the program.

Heart rate responses to a constant work load were lower in all but one subject for whom there was very little change over the total program. This indicates a greater efficiency of cardiovascular function after training.

Predicted oxygen uptake values were improved in all except the one depressed male patient. The amount of improvement did not correlate well with the adherence to the schedule.

The group as a whole exhibited positive self concept benefits of participation. The starting scores were significantly different from the published norms, but were brought into the range of normal by the end of the program. There was only one exception to this, which was the Physical Self Score (how one sees one's body, state of health, physical appearance, skills and sexuality), which remained significantly different from normal.

Functional improvements were variable. One of the 3 males had a marked improvement, with reduction in spasticity resulting in improved gait, and greatly improved endurance. The other two males showed very little functional change. Three of the five women showed marked functional improvements, including greater stamina, and greater awareness of sensation in the affected side.

More patients are currently undergoing this program.

APPLICABILITY: If feasibility is demonstrated for hemiparetic patients by this investigation, this will provide a rationale for a new type of rehabilitation service for patients who have hemiplegia, which may be of benefit in increasing their overall confidence and function. Future studies may then be implemented to investigate the effects of this type of exercise, using controlled trials.

184 Project to Document the Development of a Cooperative Group Residence for Severely Physically Disabled — Boston Center for Independent Living, Inc. (BCIL)

Principal Investigator:	Paul Corcoran, M.D.	
FY 1976		
Status:	Continuing	
Dates:	August, 1974-October, 1975	
Cost:	Annual $9,164 RT Annual $8,684	Projected Total $7,284 (RT) RT % of Annual Total 95%
Annual Report Reference:	#10, Page 271, R-55	
FY 1977		
Status:	**Continuing**	
Dates:	**August, 1974-October, 1976**	
Cost:	**Annual $6,143** **RT Annual $4,877**	**Projected Total $13,560 (RT)** **RT % of Annual Total 79%**
Annual Report Reference:	**#11, Page 187, R-55**	

OBJECTIVES: This project was designed to (1) assist in the development of a group residence on the Boston University Campus, (2) document the process, and (3) evaluate the first year of operation.

METHODOLOGY: A coalition of state agencies, institutions and interested individuals pooled energy, information and resources to fund and staff an action-oriented non-profit organization capable of training severely disabled persons to manage their own lives outside of an institutional setting. With the cooperation of Boston University, rooms in a dormitory were made accessible and students were enrolled in the program. Success with the first nine students led to expansion. To date, 50 individuals have participated in the BCIL program; many are now living independently.

FINDINGS TO DATE:

The process at BCIL involved three stages:

a. Transitional living. Initially on the Boston University campus, this has since broadened to include several other sites. One is a modern, accessible housing project in Brookline, MA. The program is a first, structured step in introducing the physically disabled individual to a working knowledge of his/her disability and basic life skills, preparatory to directing one's own Personal Care Assistants.

b. For motivated individuals with severe limitations, Cluster Housing developed as an intermediate step, with minimal structure and peer support in apartments more integrated with the community at large.

c. Independent living: Individuals are assisted in locating accessible apartments in the community at large. Often these apartments are shared with live-in Personal Care Assistants whose services render the physically disabled individual more independent.

Out of this three stage process, we have determined that the final goal, independent living, is feasible, realistic and cost competitive. BCIL facilities are less costly than a Level I nursing home or a chronic care facility.

APPLICABILITY: The success of this program to date (in the face of some acknowledged administrative difficulties) has demonstrated that independent living is a meaningful and realistic goal for persons with severe physical disabilities. We are now using BCIL veterans to develop programs which, extended to include rehabilitation professionals and beginning earlier in the rehabilitation process, will provide more incentives to encourage physically disabled individuals to strive for a life more productive than previously believed possible.

185 Effective Training in Rehabilitation Medicine in New Medical School Curricula*

FY 1976		
Status:	New.	
Dates:	October, 1974-September, 1976	
Cost:	Annual $3,450 RT Annual $3,450	Projected Total $6,990 (RT) RT % of Annual Total 100%
Annual Report Reference:	#10, Page 275, R-56	

Principal Investigator: **Justus F. Lehmann, M.D.**
FY 1977
Status: **Continuing**
Dates **October, 1974-September, 1976**
Cost: **Annual $3,450** **Projected Total $6,990**
RT Annual $3,450 **RT % of Annual Total 100%**
Annual Report Reference: **#11, Page 257, R-56**

* This Project is being funded by a consortium of R&T Centers. Work on the project will be conducted by social scientists in the Health Manpower Division of Inter-Study, who for the past ten years have served as the research staff of the Commission on Rehabilitation Medicine.

OBJECTIVES: A major objective of this project is to determine the extent to which exposure to rehabilitation medicine education experience helps to develop in all medical students an understanding of the nature of chronic illness and its complications, and a working knowledge of the contribution which rehabilitation medicine offers to meet the multiple needs of the chronically ill. Specifically, the project will attempt to determine whether this exposure stimulates positive attitudes toward rehabilitation medicine, a working knowledge of rehabilitation medicine principles, and effective practice behavior in providing care for the chronically ill and severely physically disabled.

A further purpose of the project is to identify newer types of prototypic rehabilitation medicine educational experiences which are effective and which are likely candidates for inclusion in today's medical school curricula.

METHODOLOGY: To accomplish its purpose, this project will assess the impacts of certain new approaches of acquainting students with RM, in a group of selected medical schools. The outcomes of these training experiences will be contrasted with outcomes of RM training in appropriate comparison medical schools, especially schools retaining the more traditional programs of RM education. Through surveys and in-depth interviews with students, residents and practicing physicians who have been exposed to different types of RM educational experiences in the schools studied, it will be possible to determine to at least some meaningful degree the important and long-lasting attitudinal and behavioral effects stimulated by various types of RM educational experiences.

Medical education is extraordinarily subtle and complicated and one could not expect to emerge from this study with clear-cut assessments. There is, for example, no compelling single criterion for the effectiveness of medical education. Therefore, a battery of attitudinal and behavioral measures for use in determining whether certain contemporary RM training experiences are relatively more effective than others has been developed. These criterion measures of effectiveness have been formulated on the basis of the goals and objectives which RM educators have identified as their aims in designing and implementing new RM educational experiences.

Further, the success of medical education cannot be measured at any one point in the physician's career. The project will study medical students, but will emphasize also physicians now in residency programs in their chosen specialties, particularly primary care. Those ex-students who are now in practice will also be followed up.

FINDINGS TO DATE: The study, partly funded by a Social and Rehabilitation Service Grant (NO: 44-P-2509/5-08) to the Commission on Rehabilitation Medicine, is already in progress. It is being conducted by social scientists in the Health Manpower Division of InterStudy, who for the past ten years have served as the research staff of the Commission on Rehabilitation Medicine.

With the limited funds available the staff has been able to design the study, prepare and revise drafts of survey instruments and identify and recruit the cooperation of several representative RM training programs which are to be the focus of the study's evaluation efforts. A consultant panel of physiatrists has been assembled to review and help finalize the survey instruments. These instruments are now ready for pre-testing.

During the design phase the Commission staff engaged in discussions with medical school administrators so that the project is clearly responsive to their exact interests. Four schools are now cooperating in the study, including the Ohio State University, the University of Cincinnati, the University of Minnesota, and the University of Washington. Additional funding is needed to secure the cooperation of eight to ten additional medical schools, secure names, addresses and educational experiences of individuals to be surveyed at these schools, collect survey data, analyze all survey and interview data, and prepare, produce, and disseminate the results and findings of this study.

APPLICABILITY:

1. National Need for Rehabilitation Medicine Services:

Specifically we hope to determine those medical school experiences which are most effective in developing both an ability and an inclination in future physicians to: 1) correctly diagnose chronic illnesses and physical disabilities; 2) prescribe and properly manage acute and long-term care; and 3) seek expert consultation and patient referral where needed.

2. Need for More Informed Medical School Curriculum Decision Making:

The late 1960's saw the substantial redesign of undergraduate medical curricula in virtually all our medical schools. Pressures to reduce the length of undergraduate medical education led in many cases to the creation of three-year and other accelerated programs. Functionally-oriented conjoint and interdisciplinary courses have in many cases replaced departmental offerings. Track systems have been designed to permit the undergraduate to focus his educational experiences in a given area relatively early in his medical career. Students now enjoy considerably more latitude in selecting elective courses and clinical experiences at numerous points throughout their undergraduate education.

186 Medical Examinations (Including Functional Assessments) of a Selected Sample from the Study of Highland Heights, a Medically Oriented Housing Project for the Physically Impaired and Elderly in Fall River

(Comprehensive Medical Examination of Experimentals and Controls in the Study for Independent Living at Highland Heights Apartments)

Principal Investigator:	**Sylvia Sherwood, Ph.D.**	
FY 1977		
Status:	**Deferred**	
Dates:	**Sept., 1973-September, 1976**	
Cost:	**Annual $5,405**	**Projected Total $925 (RT)**
	RT Annual $925	**RT % of Annual Total 17%**
Annual Report Reference:	**#11, R-52**	

OBJECTIVES:

1. To analyze relationships among medical conditions, physical functioning, social and psychological variables;
2. To analyze the relationships between these variables and assessments of need for Highland Heights; and
3. To gain insights concerning developments in the lives of handicapped and elderly persons who moved into this new type of medically oriented housing from a long-term care facility.

METHODOLOGY: Using precoded examination forms adapted from the Tufts programmed history, physical and functional assessment forms, the available sample previously selected and given medical examinations from among residents and applicants will be again examined as well as an additional group of residents from the larger study sample, to include the resident member of additional matched pairs plus residents who moved into Highland Heights from a long-term care facility (whether or not they are part of the matched pairs experimental sample).

FINDINGS TO DATE: Of the 132 sample members, 117 residents and 15 non-residents who have been examined to date, approximately 72 were examined as part of this year's activity.

There was a slight relationship between the physician's rating of need and age and, what might seem unexpected, with the younger group being more likely to be rated as having a high need for Highland Heights.

A significant relationship was found between need and major handicapping condition, with those rated as low in need much less likely to have a major handicapping condition or a "general condition" other than a cardiac condition.

A relationship was found as well between high need for medically oriented housing and the number of other impairments and health risks.

Relationships were also found in the expected direction between the judgment of need of medically oriented housing and the physician's ratings of level of stamina, psychological status and, to a large extent, the PULSES functional profile.

APPLICABILITY: Chronic illness and disability are among the foremost health problems today. With the increasing numbers of chronically ill, elderly and handicapped adults in the population, increasing consideration is being given to alternatives in providing rehabilitation services and to preventing the need for institutionalization, or at least preventing chronic institutionalization.

The medically oriented housing as represented by Highland Heights can be considered an important innovative alternative in long-term care, one which takes into consideration not only the medical and physical functioning needs but environmental aspects of rehabilitation including social supports and activities related to quality of life.

187 Nerve Conduction Studies as a Method of Differential Diagnosis of Neuropathies

Principal Investigator:	Kamal B. Labib, M.D.	
FY 1976		
Status:	Continuing	
Dates:	March, 1973-December, 1976	
Cost:	Annual $966 RT Annual –	Projected Total $449(RT) RT % of Annual Total –
Annual Report Reference:	#10, Page 129, R-34	
FY 1977		
Status:	**Discontinued**	
Dates:	**March, 1973-December, 1976**	
Cost:	**N/A**	
Annual Report Reference:	**N/A**	

OBJECTIVES: Dyck and Lambert have developed a valuable technique for studying the action potentials of peripheral nerves **In Vitro.** One of the main objectives of the present study will be to refine this technique. This, in turn, will increase the ability to make more specific diagnoses of certain peripheral neuropathies in patients with neurologic disease.

METHODOLOGY: An effort to be made to study the different components of the compound action potential and to correlate them with different types of nerve fibers. This to entail isolating the different fibers and stimulating each group separately. When the animal study is completed, proceedings to the **In Vitro** examination of sural nerve biopsies from patients with peripheral neuropathy of unknown etiology.

FINDINGS TO DATE: This project was suspended during the grant period (11/1/74-10/31/75) because of a lack of funds. No activities were conducted and no expenditures were made.

APPLICABILITY: N/A

188 Voice Activated Transducer for the Severely Physically Disabled

Principal Investigator:	Richard A. Foulds, M.S.	
FY 1976		
Status:	Continuing	
Dates:	November, 1973-October, 1976	
Cost:	Annual $4,277 RT Annual $3,736	Projected Total $9,079 (RT) RT % of Annual Total 87%
Annual Report Reference:	#10, Page 187, R-43	
FY 1977		
Status:	**Discontinued**	
Dates:	**November, 1973-October, 1976**	
Cost:	**N/A**	
Annual Report Reference:	**N/A**	

OBJECTIVE: To design and construct a reliable, reasonably priced voice activated transducer that is cosmetic in appearance, conveniently used, and capable of responding to the spoken digits 0-9 and performing the necessary functions to activate the controlling system.

METHODOLOGY: The necessary features of a voice activated transducer will be obtained from a joint study undertaken by RT-7 and the West Roxbury Veterans Administration Hospital. The desirable functions of this unit will be studied and the parameters for a smaller, less expensive unit will be established. The project also continues to research alternate methods of voice encoding. This research will rely very heavily upon work that has been described in the literature. In this research project, what is planned is to review the early designs for digit recognition and choose the most usable accoustical parameters. New circuitry, using state of the art components, will be designed. In addition, a calibration method will be devised to allow easy timing for a specific client.

PROGRESS AND FINDINGS:

1. Progress towards the design and construction of a voice activated transducer was impaired by changes in funding priorities. It was possible to continue to literature search and begin to analyze spoken digits from an accoustical viewpoint. Voice prints were made. Utilizing available funds, minor purchases of electronic components were made. These are being used for breadboard circuits in experiments in methods of filtering and amplifying speech.
2. A knowledge of existing controlling devices has been acquired through work on and with other RT projects as well as correspondence with individuals and agencies involved in this type of work. Extensive data has been gathered on the work performed at Bell Laboratories and other institutions.

APPLICABILITY: A device which uses speech, normal function, and is almost physically unnoticeable, may reduce the amount of reluctance a patient has to use it. The prime features are ease of use and cosmetic appearance.

189 Brown University-VR-CHIP-RT-7 Program

Principal Investigator:	Carl V. Granger, M.D.	
FY 1976		
Status:	New	
Dates:	January, 1975-July, 1975	
Cost:	Annual $19,660 RT Annual $3,450	Projected Total $6,990 (RT) RT % of Annual Total 18%
Annual Report Reference:	#10, Page 259, R-54	
FY 1977		
Status:	**Discontinued**	
Dates:	**January, 1975-July, 1975**	
Cost:	**N/A**	
Annual Report Reference:	**N/A**	

OBJECTIVES: A survey of Rhode Island has shown a paucity of restorative services and facilities, either for care of patients and clients or for training medical professionals in the skills of rehabilitation. To develop an organizational model that will:

a. Fulfill the intent of the statute to provide effective health and rehabilitation services to those suffering catastrophic effects of illness, injury or defect;
b. Provide the Vocational Rehabilitation program with trained personnel and adequate facilities to enable each individual to reach his optimal rehabilitation potential;
c. To develop an efficient data management process for analyzing care of individuals as well as for determining overall program effectiveness;
d. Provide Brown University Program in Medicine with a network of associated facilities related to existing community hospitals, health programs and social agencies that will stimulate services, education and research in the solutions to problems of chronic handicap.

METHODOLOGY: Rhode Island's Catastrophic Health Insurance Plan (CHIP) was enacted in January 1975 and is designed to protect Rhode Islanders against the staggering costs of a catastrophic illness or injury. Assessments are to be made of the conditions that receive financial support from CHIP and the distribution of costs from those conditions.

Task Force committees were organized to review the status of and recommend actions to help implement a statewide rehabilitation service network. Under sponsorship of the Office of Associate Dean of Medicine of Brown University, an Advisory Committee has completed a published report utilizing the findings of the task force committees.

FINDINGS TO DATE: Liaison has been made with the Section of Community Health at Brown University and two health planning problems have been assigned to medical students during the six week clerkship. These culminated in surveys on 1) the degree of problems produced by stroke throughout Rhode Island and 2) a survey and recommendations for alternatives in caring for the long term patient.

New inpatient rehabilitation units are being organized at Memorial Hospital in Pawtucket and at the General Hospital of the Rhode Island Medical Center (at RIMC this represents reactivation and increased staffing for a unit previously developed). Both of these units and the Metropolitan Visiting Nurse Association in Providence have adopted use of the RT-7 Long Range Evaluation Summaries (LRES). The computer program is being developed in the computer department of Memorial Hospital.

APPLICABILITY: After several years, the following would be created where none currently exists:

1. A unique Section of Rehabilitation Medicine within the Division of Biology and Medicine at Brown University with broad humanistic interests and activities, working in integrated fashion with the State Vocational Rehabilitation Agency and a wide spectrum of on-campus programs and departments, and with connections to myriad community agencies and facilities in the Rhode Island region.
2. A unique regional system of rehabilitative care with broad community and environmental impact, including not only traditional restorative services but also innovative community planning in nutrition, transportation, housing and other related areas, producing ideal community facilities and services and optimal care for residents of the Rhode Island region.
3. A regional data base and documenting capability supporting research and educational activities and producing scholarly reports of significance nationally and internationally.

Temple University (RT-8)
Medical Rehabilitation Research and Training Center

CORE AREA

Neurological and Neuromuscular Diseases

To advance knowledge and practices related to the rehabilitation of patients impaired by neurological and neuromuscular diseases through new initiatives for program activity such as participation in program development, execution and evaluation by handicapped persons themselves, and new concepts of impairment and disability such as the one developed by the World Health Organization.

TEMPLE UNIVERSITY

F. Ray Finley, Ph.D., Acting Director
Temple University Medical
Rehabilitation Research and Training Center
Krusen Research Center
12th and Tabor Road
Philadelphia, Pennsylvania 19140

PROJECT TITLES BY FY 1977 STATUS

COMPLETED

Abstract No.

Fundamental Study of Human Locomotion (F. R. Finley, Ph.D.) 190
Postural Control in Neurosensory Disability: Functional Implications and Therapeutic Management (T. Cook, M.S.P.T.) 191
Further Studies of the Pathophysiology of Spasticity (N. Mayer, M.D.) 192
Applications of the Evoked Electrospinogram (A. W. Monster, Ph.D.) 193
Lateral Postural Control and Locomotor Performance in Normal Subjects and Patients with Neurologic Deficits (T. Cook, M.S.P.T.) 194

CONTINUING

Application of Dynamic Palatography in Organic Speech Disorders (Former Title Oral Function in Upper Motor Neuron Lesions) (J. Zafran, D.D.S.) 195
Postural Control in the Initiation of Gait: Normal and Pathological Mechanisms (T. Cook, M.S.P.T.) 196
Response Oriented Sensory Aid for Assessment and Treatment of Oculomotor Dysfunction (E. Kwatny, Ph.D.) 197
Role of Feedback in Control of Motor Function (A. W. Monster, Ph.D.) 198
Multi-Electrode Studies of Patients with Spastic Central Nervous System Disorders (N. Mayer, M.D.) 199
Visual System Disorders and Functional Correlates (E. Kawatny, Ph.D.) 200
Motor Unit Composition and Voluntary Force in Neuromuscular Disease (A. W. Monster, Ph.D.) 201
Motor Control and its Relationship to Functional Activities (W. Freedman, Ph.D.) 202
Development of a Model Demonstration Rehabilitation Service (A Research Utilization Service) (N. Mayer, M.D.) 203
Computer Characterization of Patient Services (E. Kwatny, Ph.D.) 204

Clinical Classification and Functional Prediction: A Study of the Stroke Population (Former Title: Locomotion and Postural Control Classification in Adult Hemiplegia: Implications for Treatment) (F. R. Finley, Ph.D.) 205

NEW

Assessment of Driving Capabilities of the Brain Injured Population (W. Freedman, Ph.D.) 206

190 Fundamental Study of Human Locomotion

Principal Investigator: F. R. Finley, Ph.D.
FY 1976
Status: Completed
Dates: January, 1970-October, 1976
Cost: Annual $45,115 Projected Total $28,690
RT Annual $45,115 RT % of Annual Total 100%
Annual Report Reference: #11, Page 34, R-120

OBJECTIVES:

1. To describe the interaction between forces and displacements which characterize normal, bipedal human locomotion;
2. to derive measures which can be analyzed and explained by the principle of laws of mechanics while having high utility for clinical application in the rehabilitation of patients;
3. to isolate, measure, and determine the relation between elements which provide bipedal locomotion. The elements and their interaction were selected with specific reference to clinical problems encountered in the rehabilitation management of patients.

METHODOLOGY: This study was conducted using special instrumentation and a special walkway. The recorded variables which become the data base by which to develop a morphological description of normal locomotion included elements of ground reaction forces (both vertical and shear components), and both the translatory and rotatory components of joint positions. The derived stance and stride periods, average body velocity, spatial coordinates for limb joint positions, joint angular (rotary) position, joint angular velocity, coordinates for the center of pressure under the foot, reaction force vectors at the substrate, movements about the three orthogonal axes passing through a limb joint, a net power developed at a limb joint, and the reference of all derived variables to the gait cycle.

PROGRESS AND FINDINGS:

1. The interaction of force displacement and time in the study of human locomotion has been under continuing investigation.
2. The natural and slow gait of 15 young adults, 7 females and 8 males, was observed. Subjectively, all were noted to have narrowed their base width of support as they decreased their walking velocity. The subjects decreased their velocity by decreasing both step length and cadence.
3. The results suggest that people walking at low velocities employ less joint motion for cushioning the impact on the center of gravity.
4. A two-part study was conducted to relate temporal measures to a broad range of walking speeds.
   A. The preliminary study included a sample consisting of seven normal young adults, three males and four females, who walked at velocities ranging over an eight-to-one difference in magnitude. The findings indicated the following relationships:
      1. Stance period is inversely proportional to the 2/3 root of velocity;
      2. Swing period is inversely proportional to the square root of cadence; and inversely proportional to the one third root of velocity;
      3. Double support period is inversely proportional to velocity;
      4. Period from tow-off to maximum flexion of the knee appears to be independent of velocity; and
      5. Period from maximum knee flexion to heel strike is inversely proportional to the square root of the velocity.

   (While the performance of each individual was quite consistent, the values for the coefficients varied among the individuals. Additionally, the relations were found to be maintained over a velocity range from about 0.7 to about 2.0 meters per second. When the subjects walked unnaturally slow [e.g., less than 0.7 meters per second], the relations tend to break down and performance tends to depart from the stereotype.)

   B. The unilateral limb function testing was completed on fourteen normal, young adult subjects to obtain definitive temporal, kinematic and kinetic data using refined measurement techniques. Data obtained from this study are being analyzed for temporal and kinematic features which characterize movement patterns. For example: a) noting the temporal precision of EMG activities with respect to gait phases as derived from foot switches and joint movements; b) relations of ranges of movement of joints with speeds of walking; c) relations of stride length and cadence, with velocity; d) analysis of the body velocity with respect to time and its relation to limb movements; and e) longitudinal shear forces and the magnitude of variance attributable to controlled versus non-controlled walking.

5. Techniques for assessing the ability to perform locomotion activities other than level walking were investigated. Normal subjects instrumented with the Limb Load Monitors and knee electrogoniometers were observed ascending and descending stairs and a ramp. The data were examined for features potentially useful for clinical applicability. The rate of change of force showed: a) correspondence with rates of ascending and descending, b) differences between left and right limb performance, and c) differences among the subjects. Accordingly, appending a differentiator to the test apparatus permitted direct recording of the rate of change of force (i.e., $\Delta f/\Delta t$). This innovation is currently being used in the study of the rheumatoid arthritics under the development activities supported by SRS Grant No. 23-P-55118, the Rehabilitation Engineering Center.

APPLICABILITY: This study will provide data for interpreting pathological gait, for design of prosthetic and orthotic devices and systems; the data will be used to evaluate needs, treatment, and progress of patients with locomotor impediment and dysfunction.

191 Postural Control in Neurosensory Disability: Functional Implications and Therapeutic Management

Principal Investigator	T. Cook, M.S.P.T.	
FY 1976		
Status:	Completed	
Dates:	November, 1971-October, 1976	
Cost:	Annual $43,480	Projected Total $217,400
	RT Annual $40,480	RT % of Annual Total –
Annual Report Reference:	#11, Page 41, R-129A	

OBJECTIVES: This proposal deals with the utilization of a "posture platform" in order to study, in a functional mode, the upright posture of patients with various neurosensory disabilities. Specifically, the objectives of this project are:

a) To develop measures of postural control which are objective, reliable, suitable for use with patients who have impaired balance ability, and are able to discriminate fine levels of postural control.

b) To use measures of postural control to assess the degree of dysfunction in various patient groups.

c) To use postural control measures to determine the effectiveness of pharmacologic agents in alleviating postural control problems.

d) To evaluate the usefulness of augmented sensory feedback in improving postural control.

METHODOLOGY: The instrumentation to be used in this investigation was described previously (See RT-8 Progress Report #10, 1973-74). The posture laboratory, with its hydraulically movable force plates, is used in conjunction with a digital computer to measure postural reactions to controlled perturbations of upright stance. Normal subjects and patients with various neurosensory disabilities stand on the platform which is perturbed anterior-posteriorly to displace the body center of mass. Control of unilateral and bilateral force applications and other pertinent parameters are evaluated.

The assessment procedure to be developed will characterize the patient's degree of dysfunction and level of postural control ability. This same evaluation will be used before and after administration of pharmacologic agents to examine their effect on postural control and will also be used to determine the usefulness of augmented sensory feedback in improving performance in patients with impaired balance.

FINDINGS TO DATE: The test procedure which has evolved measures patient responses to continuous unpredictable translations of the posture platform, i.e., anterior-posterior movements in the horizontal plane. The entire test procedure takes less than ten minutes, allows for ample rest periods, if necessary, aid is well-tolerated by the various patient groups. The normal data base for this test procedure has been expanded from the previously reported 30 subjects to a current total of 59. Likewise, the sample of hemiplegic patients who have been tested now totals 31, and the number of patients with cerebellar/brainstem disorders has been increased to over 20.

The expanded data base has added further support to the previously reported finding that this test procedure provides measures of postural stability which are: a) objective, b) satisfactorily reliable, c) acceptable to the patients for whom they are intended, and d) able to discriminate various levels of postural steadiness. Figure 1 shows the form used to record the test results (See Progress Report #12, 1975-76). This form has been introduced into the charts of patients on the research utilization service (See Project R-147, page 137 of same report), and is being used routinely to assess the effectiveness of various therapeutic activities which are designed to alleviate postural control problems.

APPLICABILITY: Since disorders of balance and equilibrium result in severe functional limitations and often are a major concern in rehabilitation, an objective evaluation of static and dynamic postural control is seen as a useful and necessary assessment procedure. This line of investigation can provide a delineation of those tests and measures with the most diagnostic significance and of those therapeutic measures which are most suitable for translation to clinical use.

192 Further Studies of the Pathophysiology of Spasticity

Principal Investigator:	**N. Mayer, M.D.**	
FY 1977		
Status:	**Completed**	
Dates:	**November, 1974-October, 1976**	
Cost:	**Annual $22,542** **RT Annual $17,695**	**Projected Total $92,000** **RT % of Annual Total 78%**
Annual Report Reference:	**#12, page 55, R-140**	

OBJECTIVES: The objectives of this investigation are:

1. To refine knowledge of the physiologic models of spasticity.
2. To develop functional and pre-functional test methods which will be used in evaluatin of various modes of treatment (e.g., reflexive, modality specific, or pharmacological).

METHODOLOGY: Assessment of therapeutic efficacy is achieved by integrating both clinical and physiological evaluative techniques over a test period which includes pre- and post-study controls as well as a span of several weeks during which the treatment is applied. Amedical history, clinical examination and specific physiological challenges to the subject's nervous system (e.g., cold, tendon taps, repetitive mechanical stimulation, functional activities, etc.) are repeated weekly.

Measurements of EMG activity, torque about the ankle joint and occurrence of spasmodic activity are recorded and compared to pre-drug control values to evaluate the efficacy of the treatment program.

FINDINGS TO DATE: The evaluation scheme has been used throughout the past year to score the clinical tests which are included in the test procedure. The scoring system weighs both the magnitude of the clinical parameter and the parameter's importance as determined by the patient's complaints about functional interference. This evaluatoin has been designed to be compatible with computer analysis as data from large-subject populations become available.

Nine patients were tested once to evaluate their spasticity. The patients presented the following etiology:

Hemiplegia	2
Traumatic Paraplegia	13
Cerebellar Atrophy	1
Parkinson's Disease	1
Multiple Sclerosis	2

The patients who were tested one time were evaluated in order to categorize their medical problems according to the models of spasticity developed earlier (RT-8 Progress Report, 1972-73) from three standpoints:

a) clinical evaluation
b) physiological evaluation, and
c) functional evaluation

The physiological and functional tests were chosen to refine the models of spasticity and to categorize the patient so that a prescriptive therapeutic program could be rationally chosen for each person.

Eight spinal cord injured patients have been evaluated multiple times (up to 11 tests) to determine the effectiveness of a possible anti-spastic agent on their therapeutic program. Identical clinical physiological and functional tests were performed each week on the patients listed. In each case, the first two and last two weeks were control tests performed with the patient not taking an anti-spastic agent. The middle test periods comprised evaluations after one week (approximately) at a particular dose level.

APPLICABILITY: Spasticity is a major concern in the rehabilitation of patients with neuro-muscular disorders because it impedes or prevents their performance of functional activities. Thus, the clinical management of spasticity will have great influence on how the patient functions within the constraints set by the sequelae of his lesion. A major component of the treatment of spasticity is the use of drug therapy. Too often, drugs are prescribed to treat the manifestations of spasticity without regard to whether or not there actually are any dysfunctional consequences to the individual patient. In this way, the functionally beneficial aspects of spasticity (e.g., flexion synergies used by a patient during gait) are often overlooked in the development of a drug therapy program.

This project will develop the information required by the physician to prescribe specific drug therapy along with other indicated therapeutic programs. The cost/benefit ratio for developing this type of information would seem to be low since there are large numbers of patients with central nervous system damage who could potentially benefit from a strengthening of the pharmacologic rationale of the treatment of spasticity.

193 Applications of the Evoked Electrospinogram

Principal Investigator:	A. W. Monster, Ph.D.	
FY 1976		
Status:	Continuing	
Dates:	November 1974-October 1976	
Cost:	Annual $9,785 RT Annual $6,785	Projected Total $19,570 RT % of Annual Total 69%
Annual Report Reference:	#11, Page 121, R-142	
FY 1977		
Status:	**Completed**	
Dates:	**November, 1974-October 1976**	
Cost:	**Annual $15,827** **RT Annual $12,101**	**Projected Total $25,112** **RT % of Annual Total 78%**
Annual Report Reference:	**#12, Page 82, R-142**	

OBJECTIVES:

a. To examine the electrical surface potentials evoked at various levels along the spinal cord by electrical stimuli to peripheral nerves.

b. To study the clinical usefulness of these potentials, including spinal nerve conduction, and their relation to radiological and other relevant clinical examinations.

METHODOLOGY: Experiments are carried out in a shielded room. The patient is tested either lying down (prone or supine) or seated in a comfortably supported position on a bed. Preamplifiers and controls for electrical stimulators and stimulus isolation units are attached to the bed with adjustable slides and clamps. All low level signal wires are twisted and shielded, and the whole setup is carefully grounded.

Recording Technique: Differential pairs of surface electrodes are located along the spine; monopolar recordings are sometimes made, as they provide a better description of the relationship between the surface evoked potentials and the underlying active neural tissue. The electrodes are placed between the spinal processes. Placement is not critical because of the relatively large depth of the nerve bundles. Four to eight pairs of electrodes are used routinely, usually at L4-L2, L3-L1, T-12-T10, T9-T7 and T3-T1.

In view of the small size of the signal (amplification is 10^5 times, between 50 and 5000 Hz), evoked response averaging is required to improve the signal-to-noise ratio. Stimuli are synchronized with the EKG and are delayed to minimize artifact. The stimulus rate is controlled by gating the EKG wave to a pulse generator, set for a specific stimulus rate.

FINDINGS TO DATE: During the duration of the project, emphasis was placed on: 1) demonstrating the basic recording method to appropriate clinical staff; 2) assisting in the purchase and testing of the instrumentation required to develop a parallel set-up at the adjacent Albert Einstein Medical Center clinical electromyography section; and 3) comparing electrospinogram waves evoked from large and small nerves. With the current set-up, consistent observations could be readily made using stimulation of large nerves (e.g., tibial and common peroneal). Consistent recordings are most easily obtained in children. Medial nerve stimulation also resulted in clear potentials. These potentials were analyzed with respect to response time (latency) from the time of the applied stimulus to the peripheral nerve to the specific recording level over the spinal column. Also, the amplitude of the evoked response was approximated. Most signals were sufficiently clearly defined, so that latency and amplitude measurements were possible.

In the present clinical set-up a total of four electrodes is monitored simultaneously using a Nicolet type 1072 4-channel averager. One electrode is placed along the nerve, two are placed along the spine, and one above the sensorimotor cortex. This arrangement is now routinely used to aid in the diagnosis of a number of spinal nerve conduction disorders and this should result in a clear outcome as to the sensitivity and applicability of this novel approach.

APPLICABILITY: The electrospinogram is expected to be of diagnostic benefit in determining spinal nerve conduction abnormalities due to traumatic injuries, dorsal root syndromes, herniated disk syndromes, metabolic disorders affecting nerve conduction, nerve compression due to extra- or intramedullary tumors, and circulatory disturbances affecting viability of neural tissue; this evaluative technique may provide data complementary to existing clinical procedures (e.g. myelography) using a noninvasive techinque.

194 Lateral Postural Control and Locomotor Performance in Normal Subjects and Patients with Neurologic Deficits

Principal Investigator:	**T. Cook, M.S.P.T.**	
FY 1977		
Status:	**Completed**	
Dates:	**November, 1975-June, 1976**	
Cost:	**Annual $11,027** **RT Annual $9,729**	**Projected Total $21,000** **RT % of Annual Total 88%**
Annual Report Reference:	**#12, Page 122, R-145**	

OBJECTIVES: The objectives of this study were to test the hypothesis that: There is a significant relationship between the free-speed locomotor cadence of certain patients with neurologic deficits and the ability of these patients to control their center of mass during lateral sinusoidal displacement of the supporting surface.

METHODOLOGY: Neurologic patients, specifically hemiplegics, and normal subjects were tested on a "posture platform" (See RT-8 Progress Reports for 1972-73, and 1973-74). The normal subjects were thirty-five to sixty years of age and free from any known neuromotor deficiency. The major selection criterion for the patients was that they have a pathological slow gait with marked instability in the frontal plane. The platform was made to translate in the horizontal plane and the subject stood upon it so that the platform movements were perpendicular to his anterior-posterior direction. A position sensor measured the movement of the subject's approximate center of mass (in the area of the second sacral vertebra) as the supporting surface is displaced sinusoidally. The center of mass movements in response to these inputs were compared within and between the normal and patient groups. Various analysis techniques, including the standard frequency response methods utilizing Fourier Analysis were used to describe and model the test subjects' responses to this test procedure. Additionally, the naively-observed, free-speed cadences of the patient group were measured and correlated with the measurements made on the posture platform.

FINDINGS TO DATE: Twelve normal subjects and eight selected patients were tested. However, the majority of the patient findings differed considerably from the preliminary results obtained in two patients who were used in formulating this project. The preliminary results from both the normal subjects and patients had indicated a lateral postural control system which could be generally characterized as a second-order system. The major difference between the normal subjects and the patients appeared to be the amount of damping. More specifically, the four normal subjects adapted a strategy whereby they absorbed the higher frequency platform movements while the two patients were unable to handle the higher frequency motion and became progressively less steady. The more precise computer-based analysis of six additional patients has shown more inter- and intra-subject variability than is acceptable. The response of these other patients is indicative of a more complex system than was anticipated.

Because of these marked differences in patient response, no single definitive measure of lateral postural control appears feasible at this time, and hence, the hypothesized relationship between lateral postural control ability and locomotor cadence cannot be evaluated. More intricate mathematical modeling of the patient responses does not appear promising or justified at this time.

APPLICABILITY: Although this project does not appear practicable at this time, the basic intent remains valid, namely, the isolation and quantification of a critical locomotor sub-skill. Experiences and information gained from this project have contributed to a project proposal currently being formulated for submission to an appropriate agency. This proposal concerns a frequency spectral analysis of movement of the body center-of-mass during on-going locomotion in both a normal and patient sample.

195 Application of Dynamic Palatography in Organic Speech Disorders (Former Title: Oral Function in Upper Motor Neuron Lesions)

Principal Investigator:	J. Zafran, D.D.S.	
FY 1976		
Status:	Continuing	
Dates:	November, 1973-November, 1976	
Cost:	Annual $54,463 RT Annual $29,463	Projected Total $163,389 RT % of Annual Total 54%
Annual Report Reference:	#11, Page 24, R-027	
FY 1977		
Status:	**Continuing**	
Dates:	**November, 1974-October, 1977**	
Cost:	**Annual $45,160** **RT Annual $30,780**	**Projected Total $140,000** **RT % of Annual Total 68%**
Annual Report Reference:	**#12, Page 23, R-027**	

OBJECTIVES:

1. To measure and record data from normals and patients with cerebral neuropathologies during performances requiring mandibular function;
2. to study normal and abnormal mandibular motion during pronunciation of specific phoneme combinations using the mandibular motion instrument;
3. to study the effect of delayed auditory feedback on normal speakers using asymmetrical auditory input, white noise, and lingual afferent anesthesia blocks;
4. to develop a computer program to automate data treatment;

5. to describe the spatial-temporal sequence of EMG activity of muscles producing the opening or closing of the mandible during phoneme production.
6. to design and fabricate an intra oral transducer which will display simultaneously with function, the lingual alveolar and lingual palatal contacts during speech.
7. to employ visual feedback with dysarthrics (and other categories of the speech impaired) as a clinical instrument for speech therapy.

METHODOLOGY:

1. The subjects include normals, hemiplegics, and other patients with cerebral neuropathologies who display clinical evidence of aphasia, dysarthria, or apraxia. The age range is 30-60 years.
2. The mandibular motion instrument consists of six potentiometers that convert the mechanical energy of jaw motion to electrical signals. The instrument is precalibrated so the electrical signal corresponds to degrees of displacement. It is attached to the subject by means of a velcro band and is connected to the mandibular incisor teeth by a rod and clutch held with dental cement. This arrangement permits free and full motion of the jaws and approximation of lips.
3. The analog information derived from the six potentiometers is recorded on analog tape for subsequent computer analysis.
4. Delayed auditory feedback is provided by an instrument which permits controlled delay in transmitting a subject's speech sounds to his auditory mechanism.
5. EMG surface electrodes are used to record the myoelectric activity of four bilateral facial muscles.
6. Two types of transducers have been fabricated. One is a customized acrylic pseudopalate (shim) containing eight contacts which display on a panel with light emitting diodes. The other shim is of printed circuit mylar that can be utilized across subjects. This shim is contained intra orally by stomahesive.
7. Tongue exercises have been developed for the purpose of improving lingual tonus and coordination. These tongue exercises are also utilized in production of simple voiced phonemes.
8. Five instruments will be distributed for testing at the following locations:
   a) Woodrow Wilson Rehab. Ctr. in Virginia — for use with brain injured (a young population).
   b) American Oncologic Hospital in Philadelphia — for test with hemi glossectomies, maxillectomies, and mandibulectomies.
   c) Moss Rehabilitation Hospital — for use with cerebrovascular accident patients.
   d) Temple University Rehab. Dept. — for use with acute care and rehabilitation populations.
   e) An Institution for the Deaf (not delegated at this writing).

FINDINGS TO DATE:

1. A computer program was developed to provide either on-line or magnetic tape replay capability for data reduction and processing of the mandibular motion data.
2. A protocol was developed and implemented to acquire information bearing on mandibular movement and its associated muscle activity.
3. To control and standardize procedures for observation, test phonemes and their arrangement in phrases were ordered to provide specific sequences of vowels and consonants.
4. Variations in lingual palatal contact have been observed in "normal" speaking individuals. The findings have been compared with a limited number of dysarthric subjects. Techniques of clinical applications have resulted in a protocol which is now ready to submit to separate investigators.
5. Impairments of speech that result from loss of motor control (as in some types of cerebral palsy, and cerebrovascular accident disease) have shown improvement across the limited population studied.

APPLICABILITY: Results of this study will contribute to the treatment of oral dysfunction in patients who have sustained cerebrovascular accidents.

1) Hearing impaired individuals should be able to visualize the correct position of their tongues during phoneme production.
2) Where dysarthria has resulted from cerebral insult applicability appears promising to strengthen extrinsic and intrinsic lingual musculature.

Therapy which improves speech production and chewing will have an important effect on the total rehabilitation process of these patients, improving their vocational potential and total quality of life.

196 Postural Control in the Initiation of Gait: Normal and Pathological Mechanisms

Principal Investigator: T. Cook, M.S.P.T.

FY 1976

Status: Continuing

Dates: November, 1971-November, 1977

Cost: Annual $14,318 Projected Total $85,908

RT Annual $14,318 RT % of Annual Total 100%

Annual Report Reference: #11, Page 53, R-129B

FY 1977

Status: **Other** ***Project terminated October 31, 1976**

Dates: **November, 1971-November, 1976**

Cost: **Annual $15,068** **Projected Total $75,000**

RT Annual $13,770 **RT % of Annual Total 91%**

Annual Report Reference: **#12, Page 47, R-129B**

OBJECTIVES:

a) To describe the process of gait initiation in normal subjects.

b) To identify pathological differences during the initiation of gait in patients with various neurologic deficits.

METHODOLOGY: For the purpose of this investigation, the initiation of gait has been defined as the series of events from the time a quietly standing subject is given an auditory signal to begin walking until that subject achieves a constant locomotor velocity. Testing is conducted on the locomotion laboratory walkway and includes normal subjects and patients with neurologic disabilities (hemiplegia, Parkinson's disease, etc.). Mesurements include: floor reaction forces in three planes (utilizing electrogoniometers); myoelectric activity from five muscle sites in each leg (utilizing surface electrodes), and velocity of the approximate center of mass (utilizing tachometer). All 29 channels of data will be sampled by a digital computer at a rate of 200 per second and stored on digital tape. Data analysis includes a calculation of ankle torque in addition to the above-mentioned measures.

FINDINGS TO DATE: In the first phase of this investigation, a study of 17 normal subjects defined how human locomotion is initiated and characterized the role of some of the central and peripheral mechanisms in the control of this behavior. In a subsequent investigation, the intention was to study gait initiation in ten hemiplegic subjects, but an examination of the data, after testing five patients, indicated a need to re-study normal subjects at very slow rates of initiation, and to modify the computer program used for this study. As evidenced by this and other studies, there is a marked difference between the free-speed velocity of normal subjects and that of various patient groups. This discrepancy demonstrates the need to describe the process of gait initiation in normal subjects when they initiate what will be a very slow gait pattern. Identifying normal function at these slow rates will facilitate the description of pathological limitations in patient groups.

The necessary computer programming changes were implemented and data collection has been completed on ten normal subjects at a wide range of speeds and ten hemiplegic patients at their comfortable speeds. Analysis of the patient data is in progress.

APPLICABILITY: The precise identification and quantification of functional limitations in the initiation of gait in various patient groups will not only provide a better understanding of the patient's pathological state but may also help to direct therapeutic activity so as to achieve optimal beneficial effects.

197 Response Oriented Sensory Aid System for Assessment and Treatment of Oculomotor Dysfunction

Principal Investigator: E. Kwatny, Ph.D.

FY 1976

Status: Continuing

Dates: November, 1971-October, 1975

Cost: Annual $31,163 Projected Total $124,652

RT Annual $26,163 RT % of Annual Total 84%

Annual Report Reference: #11, Page 58, R-135

OBJECTIVES: To develop a system to objectively assess oculomotor function. In addition, it is expected that this system will be extended to provide feedback of oculomotor performance. Toward this goal the following objectives are being pursued: identification and description of oculomotor (OM) function and performance; determination of the functional implications of OM deficits; establishment of landmarks for OM performance during the course of rehabilitation; and, characterization of OM performance indices as related to specific rehabilitation procedures.

METHODOLOGY: In order to develop a complete profile of a subject's oculomotor function and its relationship to functional visuo-motor performance, each subject is evaluated in four different examinations.

a. **Medical Screening:** A general medical statement is taken from each subject with concentration on questions dealing with neuro-muscular status, vision history, visuo-motor and ADL performance, and social behavior.

b. **Clinical Optometric Examination:** Subjects are given a complete optometric examination including analysis of near and far acuity, ophthalmoscopy, visual field analysis (central and peripheral), and an external examination (detection of phorias and tropias, motor field and motility examination, vergence and stereopsis testing).

c. **Oculomotor Function:** Quantitative analysis of eye movements during monocular and binocular viewing tasks involving a single spot stimulus in a 60 degree field. Testing of most of the sub-systems involved in controlling eye position is performed including analysis of fixation, smooth pursuit, saccadic movement, voluntary movement, and optokinetic nystagmus.

d. **Visual Perceptual and Visuo-Motor Examinations:** In order to examine functional visuo-motor activities of a subject, visuo-motor and visual perceptual tests are applied to assess whether the subject's visuo-motor activities are limited and to assess whether the limitations result from visual or motor deficits or both. Visuo-motor activity is tested using a 5 by 5 matrix of lights which are randomly lighted and are extinguished by having the subject touch the lighted position. Time and accuracy in acquiring the lighted stimulus are measured. Background illumination is varied (subdued lighting and total darkness) to permit examination of influences of visual and kinesthetic feedback on motor control.

Visual perception, including form perception, form constancy, spatial relationships, visual memory and visual discrimination is examined using the Motor-Free Visual Perception Test (a non-motor and non-cognitive test).

FINDINGS TO DATE:

Visual Perception: The Motor-Free Visual Perception Test was originally developed for and standardized to children to age 9. The test was administered to 17 normal subjects (ages 22-68) in an attempt to define normal standards of performance for adults. The average score for normal adults was 34 out of 36 with a standard deviation of 2.53. The scores were not age related. The test was given to 13 hemiplegic patients (nine left hemiplegics and four right hemiplegics) ages 43 to 76. In general, patients scored lower than normals (average score = 25.28, standard deviation = 6.26) and left hemiplegics scored lower than right hemiplegics. Further analysis was performed to examine the influences of visual field restrictions or functional neglect.

Visuo-motor Coordination: Visuo-motor responses were graded in terms of time and accuracy (distance from target) of target acquisition. Seventeen normal subjects tested used either dominant or non-dominant limb. There was no significant difference between use of dominant or non-dominant limb. In normals, speed of response was independent of background illumination but accuracy decreased in total darkness. Accuracy and response time did not vary as a function of position of target presentation. In general, hemiplegic patients responded more slowly than normals in both conditions of background illumination. For most patients, accuracy was similar to normals when visual feedback was available. With no visual feedback, accuracy decreased much more than that of normal subjects. Patients exhibiting moderate to severe signs of functional neglect in ADL are found to be furthest from normal scores in time and accuracy.

Oculomotor Function: Eye movements of ten of the hemiplegics studied during this period were analyzed in detail. The purpose of this analysis was to identify characteristics or features of eye movements which could be used to separate abnormal behavior. A total of 21 characteristics in the following categories were described: characteristics of saccades, characteristics of smooth pursuit, position maintenance, and general performance. Although as much objectivity as possible is used in measuring these parameters, some are by definition subjective and this is the difficulty in defining algorithms for automatic data processing. Several performance parameters appear to be consistently abnormal in hemiplegics. Patients exhibit more binocular asynchrony than normals, and they require a longer time to acquire a stimulus when it moves abruptly. This is manifested by several factors including slower movement velocities, a large number of corrective movements and a variable latency between these corrective movements. Hemiplegics exhibit obvious oscillatory movements during the attempted fixation of very slowly moving stimuli.

198 Role of Feedback in Control of Motor Function

Principal Investigator:	A. W. Monster, Ph.D.	
FY 1976		
Status:	Continuing	
Dates:	November, 1972-October, 1975	
Cost:	Annual $47,500 RT Annual $46,000	Projected Total $142,500 RT % of Annual Total 97%
Annual Report Reference:	#11, Page 82, R-137	

OBJECTIVES: To examine the normal control of voluntary muscle contraction with respect to:

1. the mechanisms of isometric force production;
2. the ability of specific sensory inputs to modulate the force output under various functional circumstances; and
3. the relationship between muscle receptor activity and the steadiness (presence of tremor) of a voluntary muscle contraction.

METHODOLOGY: Experiments are carried out in a shielded room whose temperature is maintained between 72-7[illegible]°F. The subject is either lying down or seated in a comfortable support position on a normal examination table or bed. The bed has an adjustable back support, can be adjusted vertically, and is equipped with mechanical fixating devices for the extremity under observation. Preamplifiers, controls for electrical stimulators, and stimulus isolation units are attached.

Procedures have been standardized for force measurements of the three muscle groups selected: extensor digitorum communis (of the middle finger); triceps brach./anconaes; and ankle dorsiflexors. Force recording and mechanical considerations are received through a variety of strain-gauge transducers. Tremor recordings during unopposed sustained extension (finger, hand, forearm and ankle tremor) are detected with a piezo-resistive acclerometer (Endevco, model 2265-20). Electromyographic (EMG) activity is monitored by surface electrodes (Beckman, Type 9852A).

Single unit recordings during isometric contraction are taken using a bipolar or concentric electrode (Disa, Type 13K 0141 or Teca CF 37, respectively) inserted at a suitable location along the muscle. The isometric response to various rates of electrical stimulation is measured at the same muscle length and information about average force production, twitch contraction times, fusion response and its relation to muscle stiffness is extracted.

Protocols for testing unit firing rate modulation as a result of activating specific sensory modalities, have been developed. By systematic comparison of unit firing rate modulation to various sensory inputs, preferential effects of afferent inputs to different units can be mapped as a function of unit size, type, and muscle function.

Data from the procedures described above are analyzed and integrated by computer. This integrated information effectively represents a functional model of voluntary muscle contraction which allows a comprehensive analysis of the following aspects: (1) the "force production-unit summation" process, including motor unit composition of total muscle; (2) the steadiness of the contraction relative to various parameters regulating the tendency of motor units to synchronize; and (3) the ability of the stretch reflex and of the intrinsic muscle response to provide effective load compensation under a variety of functional motor acts and loading conditions.

FINDINGS TO DATE: A detailed analysis was made of the neural, muscular, and mechanical factors which dominate the tendency of stretch reflexes to increase the unsteadiness (tremor) of a voluntary muscle contraction by inducing synchronization in motor unit firing. Physiological tremor was found to be dominated by two frequency bands (three if cardiac effects are included): the intrinsic forcing function which originates in the regular firing rates of the alpha motoneurons, and the peripheral resonance frequency determined by the rheologic properties of muscle and tendon and by the inertial load on the muscle.

To date, the course of this investigation has: (1) developed clinically applicable measurement techniques for determining the motor unit composition of skeletal muscle; (2) described the voluntary force production process in terms of this composition and in terms of relevant neural mechanisms; and (3) related the neural mechanisms of voluntary force production to functional characteristics of the force output, such as steadiness and strength. Most importantly, investigators have obtained the kinds of standards and routine techniques required for the functional examination of voluntary force production disabilities in a large number of neuromuscular diseases.

Results from the tremor study are currently utilized at Moss Hospital in the evaluation of tremorolytic and muscle relaxant effects of the drug Dantrolene Sodium (Monster (12)). The techniques that were developed for motor unit composition analysis form the basis of a proposed clinical study that aims to provide comprehensive and quantitative diagnostic data on the functional consequences of a number of neuromuscular diseases.

APPLICABILITY: Disorders of voluntary motor function pose serious therapeutic problems. Insufficient effort has been concentrated on correlating specific neuro-physiological changes with specialized and detailed tests of motor dysfunction. Such clinico-physiological information may be essential to improve treatment of motor disorders, to stimulate specific therapeutic approaches, and to guide the development of better diagnostic and therapeutic devices.

199 Multi-Electrode Studies of Patients with Spastic Central Nervous System Disorders

Principal Investigator: N. Mayer, M.D.

FY 1976

Status: Continuing

Dates: November, 1974-October, 1977

Cost: Annual $22,655 Projected Total $67,965

RT Annual $22,655 RT % of Annual Total 100%

Annual Report Reference: #11, Page 116, R-141

FY 1977

Status: Continuing

Dates: November, 1974-October, 1977

Cost: Annual $36,499 Projected Total $93,000

RT Annual $32,499 RT % of Annual Total 89%

Annual Report Reference: #12, Page 64, R-141

OBJECTIVES:

a. To record EMG firing patterns from multiple muscle sites during arm movement.

b. To describe spatial and temporal characteristics of the EMG patterns with respect to arm movement for the purpose of movement classification.

c. To describe movement patterns of patients with spastic central nervous system disorders.

d. To classify patients with spastic central nervous system disorders according to movement — EMG patterns.

METHODOLOGY: A six channel electromyographic amplifying and recording system is fully operative. Surface electrodes with built-in preamplifier circuitry are being used to eliminate movement artifact. Display of EMG signal, timing lines, and task event markers are in the form of a paper read-out provided by a Honeywell visicorder with optical galvanometers. Goal-oriented motor tasks are being investigated to simulate functional and prefunctional types of activity. For example, normal and hemiplegic subjects have been asked to respond to a visual command signal and extinguish a light behind a grid by touching the grid with a conductive rod. The command signal as well as the signal indicating achievement of the motor goal (extinguishing the light) are recorded on paper as square wave pulses along with electromyographic activity of six upper extremity muscles at one time.

Use of video-taped recordings of the subject during performance of goal-oriented motor tasks is also being explored as a method of correlating movement patterns with EMG activity.

Volitional forward flexion of the arms is being studied. Linear potentiometric transducers are mounted on the upper arms in order to measure flexion-extension displacements and velocities. Surface electrodes are mounted over the bellies of anterior and posterior deltoid, pectoralis major and latissimus dorsi, upper and middle trapezius. Electromyographic signals from these muscles are rectified and integrated. Subjects are requested to perform flexion movements of the arms at similar displacements and various verbal command rates, e.g., "slow", "natural", "fast", "very fast". Movement and EMG patterns are recorded on tape and manually reduced from polygraph records. Computer reduction of data is under development.

FINDINGS TO DATE: Most of the efforts for FY 1976 have been directed towards construction and design of suitable instrumentation and mechanical apparatus necessary to investigate various aspects of voluntary upper extremity movement.

The Center is currently in the process of developing a test instrument of the functional "work space" of the upper extremities. Conceptually, this instrument will define a series of locations in space within the ordinary functional reach of the upper extremities. Each location will be electronically instrumented so that contact will provide a recorded event marker simultaneously with upper extremity EMG activity. The objective of the test device is to define the reach space of hemiplegic patients in various stages of clinical recovery. Results will be described in terms of a graphic "extremity reach field" much as visual deficits are described by a graphic visual field chart.

The Center is also currently developing a test instrument for upper extremity motor activities in a two-dimensional plane. Electrically conductive paper will be applied in strips to ordinary paper in various shapes and tracks to simulate continuous as well as discontinuous motor pattern activities in the plane (both horizontal and vertical). An instrumented pencil or stylus is applied by the subject to the test instrument and locate markers are recorded as electrical contact is made or broken. The desired pattern as well as the performed pattern are thus known or recorded and correlation can be made with multi-electrode elecromyographic activity from upper extremity muscles.

During FY 1977, the study concentrated on normal subjects in order to set standards for evaluating the performance of patients with movement disorders. Normal subjects demonstrate different EMG patterns for movements performed at different velocities. For "slow" and "natural" flexion of the arm, electromyographic activity in agonist and fixation muscles is continuous throughout flexion displacement of the arm. Antagonist muscles show minimal activity or are completely silent. "Fast" and "very-fast" flexions of the arm reveal a much different pattern. Bursts of EMG activity often develop synchronously in agonist and fixation muscles and initial bursts cease well before flexion displacement is completed. Antagonist bursts often develop asynchronously with respect to agonist EMG firing and they punctuate the silent period following agonist activity. Temporal and spatial recruitment of the various muscles vary as a function of velocity and amplitude of displacement. These findings are consistent with observations from the literature which also suggests that different motor control mechanisms are respnsible for "fast" and "slow" movements.

APPLICABILITY: Large numbers of patients are disabled by central nervous system disorders which result in motor impairment and spasticity. These include victims of stroke (3,000,000 cases), multiple sclerosis (250,000 cases), spinal cord injury (60,000 - 100,000 cases), and cerebral palsy. Many of these patients could achieve greater functional independence through appropriate rehabilitation training techniques and drug management. This project addresses itself to the underlying pathogenic mechanisms of spastic central nervous system impairment in order to establish a clearer rationale for drug and exercise therapy and sensory augmentation techniques in these disorders.

Patients with spastic central nervous system disorders (as well as central disorders with features other than spasticity) have clinically well known movement dysfunction. Movements ultimately depend on muscles and how the brain recruits these muscles for the task at hand. This study seeks to describe and classify movement dysfunction for a simple arm motion in order to identify motor control features which are retained or need to be retrained in patients with central nervous system disorders.

200 Visual System Disorders and Functional Correlates

Principal Investigator: **E. Kwatny, Ph.D.**

FY 1977

Status:	**Continuing**	
Dates:	**November, 1975-October,**	**1978**
Cost:	**Annual $35,093**	**Projected Total $90,000**
	RT Annual $31,493	**RT % of Annual Total 89%**
Annual Report Reference:	**#12, Page 87, R-143**	

OBJECTIVES: The purpose of this project is to provide a quantitative clinical physiological-functional analysis of certain visual system disorders. The disorders of interest are related to the inability to adequately position or maintain position of the eyes in order to provide sufficient visual information to the central nervous system. Specifically:

a. To establish a sequence of tests to objectively measure the function of the supranuclear control systems (participating in the control of eye movements) which integrate visual and non-visual stimuli to position the eyes so that basic and skilled functional activities may be accomplished.

b. To quantitatively evaluate functional activities such as visuo-motor skills and visual perception to determine the influence of visual system disorders on dysfunction.

c. To investigate new therapeutic approachesmodify visual behavior so that it is more appropriate to functional activities.

METHODOLOGY: **Population:** normal adult subjects (18-75 years of age); hemiplegic adults (18-75 years of age); adults with neurological disease with manifestation of ocular dysfunction (18-75 years of age).

Test Procedure: a) medical screening — a general medical history statement is taken from each subject with concentration on questions dealing with vision history, visuo-motor performance, ADL performance, and neuro-muscular status. Site of lesion, functional loss, current therapeutic program and visual system impairment is acquired from clinical notes and therapists. b) Clinical optometric examination — this examination includes ophthalmoscopy, analysis of near and far acuity and visual field analysis (central and peripheral), and an external examination (detection of phorias and tropias, motor field and motility examination, vergence and stereopsis testing). c) Visual system mechanisms — eye and head movements are examined during monocular and binocular viewing of a single spot stimulus in a 60 degree field. In order to evaluate the specific supra nuclear eye movement control systems, sequences of tests including several fixation, smooth pursuit and saccade generating tasks, are utilized. Saccadic and smooth pursuit tasks are performed with both the head restrained and unrestrained. This permits examination of the integrated actions of the vestibular and cerebellar systems in the control of eye movements. d) Visual perceptual and visuo-motor examinations: in order to examine functional visuo-motor activities of a subject, visuo-motor and visual perceptual tests are applied to assess whether a subject's visuo-motor activities are limited, and whether the source of these limitations are visual and/or motor. Visuo-motor activity is tested using an array of 25 lamps which are randomly lighted and are extinguished by having the subject touch the lighted position. Time and accuracy in acquiring the lighted stimulus are measured. Background illumination is varied (subdued lighting and total darkness) to permit examination of influences of visual and kinesthetic feedback on motor control. Visual perception, including form perception, form constancy, spatial relationships, visual memory and visual discrimination is examined using the Motor-Free Visual Perception Test (a non-motor and non-cognitive test). This test has been expanded to include the figures spatially reordered to the opposite side of the midline to evaluate visual neglect. An analysis of visual behavior during this test is accomplished by measuring horizontal and vertical eye movements during administration of the test.

FINDINGS:

1. **Visual Perceptual Performance:** The regular and "reversed" format of the Motor Free Visual Perception Test (MFVP) was given to 4 normal subjects in order to compare performance on the two formats and to define the normal composite perceptual score. The scores of each test and the composite fell within the standard deviation for normal performance on the regular test format as previously defined. Ten patients were given the regular and reversed formats. The data suggest that the administration of the reversed and the regular format of the MFVP is thus far the most valid method we have used for separating and defining hemiplegic test behavior with regard to unilateral neglect and perceptual deficit.
2. **Visuo-motor Performance:** Six normal subjects were tested using dominant and non-dominant limb. Neither response time nor accuracy was significantly affected by use of the non-dominant limb, thus, it is assumed that patient responses would not be influenced by use of a non-dominant limb. Cerebellar patients tested with this device scored below normal accuracy limits in all quadrants. Response times were greater than for normals although with no visual feedback of limb position the response time became nearly normal. In general, hemiplegic patients acquired the stimulus with normal accuracy but with longer response times than did normals.
3. **Visual System Mechanisms:** Patients with hemianopsia who exhibit functional visual neglect or do not have the awareness of their field loss were found not to respond to an instantaneous change of position of a spot stimulus into their blind field. There was no initiation of a search pattern of any kind. Other patients that have become aware of their restricted field will initiate a search for the

stimulus. A characteristic searching movement is seen in this patient's small amplitude, small intersaccadic intervals. Several hemianopic patients have been observed with smooth pursuit eye movements in the presence of a moving reference but at a velocity different from that of the reference (the physiological basis for this is unknown). Compensation for visual field loss is a necessary precursor to the acquisition of functional activities following cerebral insult. Various types of compensatory eye movements in hemianopsia have been observed. A patient with a diagnosed exclusive cerebellar lesion was examined. Oculomotor abnormalities of smooth pursuit and increased vestibulo-ocular excitability were observed in confirmation of the diagnosis.

APPLICABILITY: Comprehensive rehabilitation programs must consider oculomotor and visual system disorders in view of their effect on the rehabilitation process. These disturbances often preclude the realization of valid ADL goals, such as dressing and grooming, as well as the achievement of balance and ambulation skills. Complete and accurate diagnosis is important in planning the most effective rehabilitation program for the patient. Most patients with perceptual motor deficits, for example, are entered into therapy programs following only a gross examination of visual and oculomotor function. Thus, it is assumed that visual input is good and treatment begins from there. This may not be the case at all; a need exists for diagnostic aids to separate visual and oculomotor dysfunction from perceptual dysfunction.

201 Motor Unit Composition and Voluntary Force in Neuromuscular Diseases

Principal Investigator: **A. W. Monster, Ph.D.**
FY 1977
Status: **Continuing**
Dates: **November, 1975-October, 1977**
Cost: **Annual $54,627** **Projected Total $96,000**
RT Annual $54,527 **RT % of Annual Total 100%**
Annual Report Reference: **#12, Page 110, R-144**

OBJECTIVES:

a. To measure motor unit composition in a representative number of patients with neuromuscular disease of varying intensity and known etiology.
b. To compare the diagnostic outcome of a number of existing and proposed (electro) myographic procedures.
c. To describe, in functional terms, the pathological changes resulting from the disease process, including compensatory changes.
d. To determine under what pathological conditions the normal organizational principles of motor unit activation and of voluntary force production, are either maintained or re-established during recovery.

METHODOLOGY: The present methodology consists of three parts that are complementary to one another:

a. **Screening of Patients and Normal Individuals:** This consists of a general medical history, including neuromuscular status, ADL, voluntary motor coordination, sports activities, tremor, circulatory and metabolic disorders, routine use of drugs, emotional attitude, commonly perceived discomforts and general tolerance. The emphasis is placed on documenting the onset and time course of the neuromuscular disorder, severity of the disability as perceived by the patient, and the history of therapeutic trials, if any. A profile of each patient's residual motor power is documented on the basis of standardized tests.
b. **Motor Unit Composition:** The unit composition of a muscle is a measure of the force-producing potential of that muscle. Total number of units in the composition is quite stable over the normal adult age range. Our current methods of composition measurement are based on the highly systematic and mostly invariant way in which a muscle's motor unit pool is volitionally activated during a slowly increasing contraction. Due to this systematic motor response, observations on the behavior of a small representative number of units characterize the average behavior of units in a muscle's motor unit pool. These observations can thus be used to obtain composition estimates.

c. **Long-Term Studies on Muscle Usage:** The level of motor dysfunction of a muscle or muscle group in a patient with neuromuscular disease is directly related to the extent in which these muscles are required to produce force in order to perform normal functions. To evaluate this relative dependency, normal individuals and patients are instrumented with surface electrodes placed at one or more muscle groups. Muscle activity is recorded for long time periods. Computer analysis of this activity considers the average degree of usage and its relation to muscle fiber type, peak power requirements of different types of functions including appropriate vocational activity, synergy linkages among muscle groups, and changes in strength and endurance with physical exercise; especially limits to improvement and age-dependency of such limits. This data is correlated with the unit composition measurements.

FINDINGS TO DATE: During the first year, emphasis was placed on the following problems:

a. The ability of patients to tolerate the EMG motor unit composition procedure for a time period long enough to allow the examiner to sample a sufficient number of units. It was found that with a highly automated data logging method a total of 20 to 40 units could be sampled in less than one hour (10 patients). This number of units was sufficient for diagnostic purposes.

b. Recording of unit firing rates as a function of voluntary effort is relatively time-consuming. Knowledge of unit firing rate responses to changes in voluntary effort is required for obtaining a composition estimate. However, it was found that the number of units to be examined can be drastically reduced because of fairly consistent relationships that exist between a unit size and its firing behavior (based on a study of 180 simultaneously recorded unit pairs). Some sources of differential firing behavior are being examined further.

c. Unit size estimates based on EMG surface potentials are unreliable for large muscles. This is a result of the nonuniform distribution of the muscle fibers of specific units throughout the muscle cross-section. A prototype size-depth normalization method was developed for the tibialis anterior.

d. Recordings of normal usage patterns were made for 8 different muscles. A number of parameters characterizing usage have been developed as a normal data base.

During the second year emphasis will be placed on: 1) clinically testing the present composition estimation method; and 2) comparing normal and abnormal usage patterns and their relationship to unit composition.

APPLICABILITY: Rehabilitation of voluntary motor functions depends on both adequate control of volition and on sufficient motor power. Whereas the problems of volition are complex and difficult to separate in identifiable component parts, the process of voluntary force production is definable in a functional-physiological sense. By diagnosing and describing the consequences of neuromuscular disease in functional terms, our understanding of the rehabilitation process is enhanced. The obtained findings lead to a clearer rationale for **therapy** in patients affected with these disorders. Significant **diagnostic** applications result from evaluative model of motor unit usage during voluntary muscle contraction.

202 Motor Control and Its Relationship to Functional Activities

Principal Investigator:	**W. Freedman, Ph.D.**	
FY 1977		
Status:	**Continuing**	
Dates:	**November, 1975-October, 1977**	
Cost:	**Annual $30,779** **RT Annual $30,779**	**Projected Total $47,000** **RT % of Annual Total 100%**
Annual Report Reference:	**#12, Page 128, R-146**	

OBJECTIVES: The primary long term aim of this project is to describe some aspects of motor control of functional activities. The specific aim as proposed is to determine if certain sensory modalities will change the EMG discharge patterns of the lower limb musculature thereby affecting the forces imposed on the skeletal structure of the subject during step-down movements. The succeeding aim is to use the methods and information achieved to study actual stair walking in a selected group of patients and to determine how certain disease-compromised sensory modalities affect this particular functional activity.

METHODOLOGY: To achieve the first objective, a group of healthy adults were asked to step down from a fixed height onto platforms of several different heights. EMG activity, knee angles and force upon foot contact were measured under several sensory conditions (e.g., normal vision, blindfold, Achilles tendon vibration). For the second objective, a group of patients will be selected who exhibit visual-perceptual difficulties and/or sensitivity to vibration. They will be required to walk stairs while EMG activity, knee angles and step-down force are being monitored.

FINDINGS TO DATE: Twelve healthy adults (14 experiments) have participated in the initial experiments. They all accomplished the stepping under all test conditions (blindfold, vibration, etc.) with no external support. The time to the peak step-down force became successively shorter as the external environment was changed from normal vision to blindfold, to blindfold with Achilles tendon vibration. Also, the peak amplitude of step-down force increased as the external environment was disturbed.

With normal vision, the subject's triceps surae EMG activity preceded the time of impact on the lower level. This apparently was to absorb the shock of the step by lengthening contractions of the ankle musculature. When the subject was blindfolded or the Achilles tendon vibrated, the EMG, prior to foot contact, was greatly reduced thus allowing greater impact forces to be applied to the body's bones and joints.

APPLICABILITY: Patients' early function demands use of their sensory systems in a functional environment. The problem presented here proposes to study one important functional activity and to determine if the responses due to sensory deprivations will be improper. The proposed protocol is particularly relevant for three classes of subjects who show evidence of: a) musculo-skeletal problems, e.g., arthritis; b) post-cerebral lesions with concomitant visual and somatosensory involvement, e.g., hemiplegia; and c) aging processes.

These subjects demonstrate various degrees of impaired motor control of upright posture and equilibrium, locomotion and skilled visuo-motor behavior. Such changes in control of movement may be, in part, responsible for the high occurrence of hip fractures observed in these groups. It has been reported that during a three year period, nearly 20% of admissions for rehabilitation following hip fracture had a history of hemiparesis. Patients in this category often exhibit visual-perceptual impairment and sensitivity to vibration; therefore, these sensory channels (namely, the visual and somatosensory) are chosen as the test modalities of importance in these procedures.

The aspects of motor control to be studied in this project are based upon some constraints likely to be found in a large patient population (e.g., people with faulty vision and sensitivity to vibration). The medical well-being of the people requires that individual motor control factors be considered to achieve the most complete vocational (as well as social and medical) rehabilitation program for the particular patient.

203 Development of a Model Demonstration Rehabilitation Service (A Research Utilization Service)

Principal Investigator:	**N. Mayer, M.D.**	
FY 1977		
Status:	**Continuing**	
Dates:	**November, 1975-October, 1978**	
Cost:	**Annual $15,460** **RT Annual $11,460**	**Projected Total $39,000** **RT % of Annual Total 74%**
Annual Report Reference:	**#12, Page 137, R-147**	

OBJECTIVES:

1. Examination of the transfer of research concepts, devices and training techniques to clinical practice areas in the large rehabilitation center.
2. Provision of an atmosphere to encourage academic and practical knowledge exchange between clinical and research personnel.
3. Provision of an inpatient environment nursing unit situation for use of devices such as environmental control and non-vocal communication devices.
4. Provision of a clinical setting for utilization of rehabilitation engineers.

METHODOLOGY: A ten bed inpatient service was established within the framework of a large rehabilitation center and adjacent to the clinical laboratories and engineering facilities of the Krusen Research Center. Patients who are admitted to this service may have specific clinical problems evaluated in the laboratories of the Krusen Center, and such information is then made available to the treating clinical therapists of the hospital. Individual programs for each patient are coordinated between the efforts of the clinical and research therapists under the direction of an attending physician. Weekly conferences are held to discuss the patient's progress in the program and to update or redesign various aspects of the program as necessary.

New concepts, devices and programs are initiated by research personnel in the Krusen Center and then demonstrated to and carried over by the treating clinical therapists. Coordination of conference schedules, patient activities, research and clinical input are the responsibility of the clinical coordinator for this program and all records and statistics are maintained by the clinical coordinator in the research center.

A rehabilitation engineer was recently added to the armamentarium of this service in order to facilitate the evaluation and adaptation of patients for environmental control systems, non-vocal communication aids and modifications or innovation in the area of sensory augmented feedback systems and other kinds of equipment. The engineer is brought into the clinical picture through the clinical staff and makes suggestions and designs which are recommended to the staff. Prescriptions are ultimately provided by the attending physician in consultation with the entire treating staff.

FINDINGS TO DATE: The routine evaluation of every patient by the multiple laboratories connected with the Krusen Center has been found to be generally nonproductive in the clinical sense. Patients are evaluated by individual laboratories, but it has been found more useful to evaluate particular problems that the patients have by those laboratories that can provide specific information which has immediate clinical relevance.

Evaluations based on clinical needs rather than routine multilaboratory evaluation, in a general way, have been most helpful. The availability of a clinical rehabilitation engineer who is specifically concerned with services for patients has proved to be of invaluable assistance in a very short period of time. Engineering input has increased the efficiency of obtaining, modifying, or developing devices to increase the functional capabilities of severely disabled patients. The presence of the clinical engineer has also relieved medical and allied health sciences personnel from the necessity of trying to solve problems that are not within their normal scope of practice.

Bi-monthly conferences have been a consistent feature of this program. The aims of these conferences are to disseminate new concepts about devices and training techniques to the clinical staff and to the resident physician staff. Guest speakers have been invited and personnel from Krusen who have completed research in specific areas have made presentations to this audience. In general this function is publicized throughout the entire department of rehabilitation medicine and has been very well attended by a large number of clinical personnel of all backgrounds and training. Specific emphasis has been placed on updating the knowledge of resident physicians in rehabilitation with the long term view of influencing their rehabilitation practice.

Concepts of environmental control systems, functional electrical stimulation systems and non-vocal communication systems have been emphasized to this group as well as to the clinical staff as a whole.

APPLICABILITY: Coordination of research and clinical teams in conjunction with clinical engineering services has provided increased efficiency in treating a population of severely disabled patients. It is noted that familiarity with newer devices such as functional electrical stimulation as well as environmental control systems has increased in the larger rehabilitation hospital setting since the advent of the service. In addition, a research utilization committee of the larger rehabilitation hospital has been functioning for more than six months and this committee is specifically charged with the screening and review of new devices and concepts for specific purchase for the hospital. It was also noted that rapport between clinical and research personnel has increased. There has been a freer exchange of both academic and practical ideas which have evolved during specific case management situations and has increased the efficacy of patient treatment. Staff has been more willing and eager to take on the challenge of some of the more severely handicapped patients who can be helped through external environmental control.

Discharge planning and coordination of inpatient activities with related community health service agencies such as the Bureau of Vocational Rehabilitation has been initiated at an earlier period and has resulted in smoother transition from hospital to home environment.

204 Computer Characterization of Patient Services

Principal Investigator: **E. Kwatny, Ph.D.**
FY 1977
Status: **Continuing**
Dates: **November, 1975-November, 1978**
Cost: **Annual $12,455** **Projected Total $36,000**
RT Annual $12,455 **RT % of Annual Total 100%**
Annual Report Reference: **#12, Page 146, R-148**

OBJECTIVES: In order to characterize and evaluate patient services leading to functional recovery, a system must be developed to manage the abundance of information related to patient status and performance. Included in the overall objectives are, considering that the feasibility of such a development and the design of the data base are established:

a. Develop a clinically oriented system for the management of clinical research data, and to evaluate and demonstrate the system using the Model Demonstration Rehabilitation Service.
b. Provide statistical summaries for analysis of long-term care programs and to reflect the effectiveness of therapy and clinical research programs on various populations.
c. Evaluate and establish relationships between clinical and research data to provide for future expansion of the data base and its management system. This is to permit more interactive use of clinical research data for prescriptive care and in the planning (development) of remediation programs.

METHODOLOGY: The technical staff (computer and information science) involved with this project will interact with the clinical and clinical research teams to better define the data relationships between testing and measurement and the data requirements for each set of evaluative tests. These data will then be used in the creation of a data base common to all patients undergoing evaluation and care in the rehabilitation service.

A data base management system will be designed based upon current methodologies in this technology and using information gained from the other RT centers that have been involved in the development of clinically oriented data base systems. Experience with an operational system will lead to the development of a sub-processor to permit statistical evaluation of data within the data base so that the effectiveness of the therapeutic programs may be assessed.

FINDINGS TO DATE: During this first year of effort, there has been activity in three areas:

1) Systems developed elsewhere: literature survey of systems developed to determine whether there are significant features in systems in use at other facilities which would be applicable to our goals and would be compatible with our computer system.
2) Data base requirements: there will be two basic components to the data base of this system. Clinical data will be derived from clinical care notes, diagnostic and functional performance evaluations (qualitative or quantitative), and research utilization information acquired from other sources. Data will also be available from clinical research studies not currently a part of the rehabilitation service. Potentially all research activities within the Center will impact on patient care and thus labora-tory data structures should be designed with forethought to assure compatibility with a clinical data base system. A data base structure was defined for laboratory data during this period and was integrated into one laboratory situation, the study of locomotion. This provides a foundation and compatibility with all further developments.
3) Structure of the multi-user computer system: an evaluation has been underway to determine what system (hardware and software) conflicts exist, what additional facilities are required, and where in the development process they must be added, in order to implement this data base system. The evaluation, so far, does indicate inadequacies in the system resources to permit total compatibility between the patient data base system and laboratory research support. Some of these limitations can be overcome by scheduling activity of the data base system at times of minimal laboratory utilization and having file editing and data analyses performed in the evening or early mornings. The more serious problem is the limited bulk data storage facilities currently available. The total on-line rapid-access data storage is only 10 million bytes. This means that only portions of a large data base can be available at any one time.

APPLICABILITY: In a program such as the Model Rehabilitation Service, the number of tests and therapy programs is increased to include new concepts and procedures, vast amounts of data become available for analysis of patient function. This system would provide a summarization of functional performance (and thus improvement). This would reflect on the relationship between therapy programs and the rate or level of recovery. Quantification of functional analysis is critical for objective evaluation of effectiveness and utilization of new rehabilitation concepts or procedures. This is true for evaluation procedures developed within and outside the Center.

The availability of all clinical data related to a particular patient assures the clinical research groups that they have all necessary information to evaluate the effects of other programs or therapy on the patients that they are treating. This is necessary to evaluate the efficacy and utility of a particular remediation program.

205 Clinical Classification and Functional Prediction: A Study of the Stroke Population (Former Title: Locomotion and Postural Control Classification in Adult Hemiplegia: Implications for Treatment)

Principal Investigator:	**F. R. Finley**	
FY 1977		
Status:	**Continuing**	
Dates:	**November, 1975-October, 1978**	
Cost:	**Annual $34,895** **RT Annual $34,895**	**Projected Total $105,000** **RT % of Annual Total 100%**
Annual Report Reference:	**#12, Page 155, R-149**	

OBJECTIVES: To develop an assessment and characterization methodology on the basis of findings presented by patients. The central concern of the methodology is the motor expression (performance) ability of patients having central nervous system disease.

METHODOLOGY: The methodology most simply described borrows from the Cronbach* expression, AXTI, where patient aptitudes are correlated with treatment interaction. Aptitude in this instance is to be regarded as any characteristic of the patient which interacts with treatment.

When reliability issues of the methods are satisfied, observations and correlations will be made among post stroke and other suitable neurologically disabled patients. These patients will be treated using functional electrical stimulation, for instance, and their summary characteristics will be reviewed in accordance with their outcome distribution.

FINDINGS TO DATE: The evaluation profile to be administered pre-therapeutically is being developed. Areas to be evaluated e.g. motor, sensory, have been defined and specific tests within each area are being collected or developed.

APPLICABILITY: Findings from this study will provide a system with which to build a classification scheme on the basis of which clinicians can make predictions of patient progress with various therapeutic techniques and devices. This will result in decreased patient evaluation time, more carryover of patient evaluation into treatment program planning, and decreased necessity to use therapeutic approaches in a trial and error fashion.

This study will also aid the research field in identification of the class or classes of patients whose needs are not met by current rehabilitation resources so that new applications can be developed specifically in consideration of these patients.

---

* Cronbach, L. J. Beyond the Two Disciplines of Scientific Psychology. In: Struening, E. L. and Guttentag, M. (eds) **Handbook of Evaluation Research,** Sage Publications, Beverly Hills, Calif., 1975.

206 Assessment of Driving Capabilities of the Brain Injured Population

Principal Investigator: **W. Freedman, Ph.D.**
FY 1977
Status: **New**
Dates: **November, 1976-October, 1977**
Cost: **Annual $32,500** **Projected Total $32,500**
RT Annual $32,500 **RT % of Annual Total 100%**
Annual Report Reference: **#12, Page 167, R-150**

OBJECTIVES: The following goals are designed to be accomplished in sequential order:

a) Development of state-of-the-art paper on assessment of driving capabilities of the brain-injured population.

b) Identification of "need" for research based on specific biological and behavioral requirements gotten from the literature survey and from on-site visits to existing driver-assessment facilities.

c) A research plan to develop a process for assessing the driving capabilities of brain-injured people.

METHODOLOGY: In order to achieve the objectives of this proposal an extensive literature search will be made in order to compile the information available concerning the brain-injured population. This will include physiological-functional information so as to specify those parameters present in the driving environment which could affect driving performances of the brain-injured. Identification of vehicle-dynamics under various road conditions will be necessary, as will knowledge of driving tasks.

Included in the search will be a review of the state and federal guidelines to determine the assessment procedures currently in use. This will also require a compilation of the procedures of medical review boards in the various states. The state-of-the-art literature review will be augmented with personal visits to selected facilities which have demonstrated expertise in driving simulation, psychological testing for driving capability, on-road instrumented assessment and treatment of brain-injured patients.

The population for which this study is proposed consists of people who must contend with dysfunctions resulting from brain injury. Individuals exhibiting sequelae of the following etiologies are included: congenital lesions (e.g., cerebral palsy); acquired lesions (e.g., tumor, stroke); and degenerative lesions (e.g., cerebellar atrophy).

From an integration of the state-of-the-art with biological-functional information, a plan for further research will be recommended to develop a method to assess the driving capabilities of patients and to develop the interface between diagnosis of medical disability and assessment of functional performance in the tasks of driving.

FINDINGS TO DATE: N/A

APPLICABILITY: It is clear that those brain-injured who are able should be provided the opportunity to operate a licensed vehicle. The questions are: how and who shall determine their driving capability? This project will attempt to suggest answers to these questions.

In addition to the independence and self-respect which is provided by mobility for the disabled, it also opens up the opportunity of self-support for the individual which benefits the individual and the taxpayer.

George Washington University (RT-9)
Medical Rehabilitation Research and Training Center

CORE AREA

Psychosocial, Vocational and Performance Capability Studies in Severe Disabilities

Research focused on the rehabilitation outcome of the severely disabled which is dependent on the interrelated areas of psychosocial, vocational and performance capability factors.

THE GEORGE WASHINGTON UNIVERSITY

Irene G. Tamagna, M.D., Director
The George Washington University Medical
Rehabilitation Research and Training Center
Room 517 Ross Hall
2300 Eye Street, N.W.
Washington, D.C. 20037

PROJECT TITLES BY FY 1977 STATUS

COMPLETED

Abstract No.

A National System for Job Development in Micrographics (K. Mallik, M.Tech., M.S., D. Engr.) 207

Comprehensive Evaluation and Treadmill Exercise Testing in Treated Patients for Hypertension (Irene G. Tamagna, M.D.) 208

Explore Means of Utilizing the Severely Disabled Homebound to Pool Rehabilitation Services Data (K. Mallik, M.Tech., M.S., D. Engr.) 209

Multimedia Rehabilitation Resource Center Project (Nina Matheson, M.L.S.) 210

Rehabilitation Training Materials Study (Nina Matheson, M.L.S.) 211

Opening Science Careers to the Handicapped (K. Mallik, M.Tech., M.S., D. Engr.) (Subcontractor: The American Association for the Advancement of Science) 212

Live Adjustment Post Myocardial Infarction: Defining Predictive Variables (Formerly Titled: Psycho Social Aspects of Coronary Rehabilitation; Life Adjustment Post Myocardial Infarction: Defining Predictive Variables) (Melvin J. Stern, M.D.) 213

Family Factors in the Recurrence and Maintenance of Alcoholism and Other Chronic Disabilities (Formerly Titled: Alcohol Abuse and the Family) (Steven J. Wolin, M.D.) 214

CONTINUING

Project Access (Donald E. Hawkins, Ed. D. and Alvin P. Johnson, M.A.) 215

Study of Emotional Forces in Psychogenic Asthma (Halla Brown, M.D.) 216

Study of Cortical Organization Using Visual and Somatosensory Evoked Potentials (Robert A. LaVine, Ph.D.) 217

Job Development and Enhanced Productivity for Severely Disabled (K. Mallik, M.Tech., M.S., D. Engr.) 218

Rehabilitation Potential of Stroke Patients as a Function of Cerebral Lesions, Visualized by Computerized Transaxial Tomography and Cerebral Blood Flow Patterns (G. Molanari, M.D.) 219

The Role of Family in Institutional Rehabilitation of Clients with Behavioral and Physical Disabilities (Formerly Titled: Role of the Family in Institutional Rehabilitation of Patients with Alcoholism, Behavior Disorders, and Delinquency) (David Reiss, M.D.) 220

Factors Influencing Patient Compliance in Patients with Ischemic Heart Disease (Jack B. Taylor, M.D. and Anne M. Acherman, M.S.N.) 221

NEW

A Pilot Project: Stroke in the Young (G. F. Molinari, M.D.) 222

Clinical Component: Medical Complications of Patients with End Stage Renal Disease (SR-9); Vocational Component: Vocational Barriers to End Stage Renal Disease Patients and Methods for Alleviation (SR-10) (Alvin E. Parrish, M.D.) 223

DISCONTINUED 1976

Rehabilitation Information Exchange Clearing House Program (Irvin C. Mohler, M.S.)

Exploration of the Role of Programmed Education in Cardiac Rehabilitation (Charles S. Tidball, Ph.D., M.D.)

DISCONTINUED 1977

Effect on Hospitalized Patients of Staff-Patient Collaboration in Goal Directed Activities (Justin A. Frank, M.D.)

Evaluation and Development of Visual Aids for Subnormal Vision Patients with Central and Paracentral Field Defects (Mansour F. Armaly, M.D.)

Rehabilitation of the Chronic Alcohol User and Abuser in the Working Society Utilizing the Intensive Psychotherapeutic Approach of a Day Treatment Center (William G. Tompkins, M.D.)

TRANSFERRED 1977

Amputee Clinic for Research and Training (William P. Fortune, M.D.)

207 A National System for Job Development in Micrographics

Principal Investigator:	K. Mallik, M. Tech., M.S., D. Engr.	
FY 1976		
Status:	Completed	
Dates:	September, 1974-February, 1976	
Cost:	Annual $33,543 RT Annual $29,400	Projected Total $60,000 RT % of Annual Total 88%
Annual Report Reference:	#11, Page 70, SR-1	

OBJECTIVES:

1. To train shop managers of rehabilitation organizations across the country to operate a micrographic system employing severely disabled workers.
2. To interconnect vocational rehabilitation facilities with industry to develop jobs for the disabled in the micrographics industry.
3. To train severely disabled people and non-disabled people to be micrographics technicians.

METHODOLOGY:

1. A syllabus has been developed and used to train a few rehabilitation personnel and severely disabled homebound and non-homebound clients. This syllabus was revised. The final training package consists of 15 chapters in a programmed manual and 6 units of cassettes with 35 mm. film strips.
2. Micrographics jobs (e.g. rotary and planetary camera operators, image-by-image film inspector, jacket loader, etc.) and their functional requirements are listed in detail and are accompanied by audiovisual aids. Rehabilitation personnel can use these materials to train physically handicapped people in their respective shops.
3. A few rehabilitation shop managers are using the materials to train the handicapped. The instructional materials are disseminated to all state directors of vocational rehabilitation agencies, sheltered workshops, and many employers (both in private industry and the federal government).

PROGRESS AND FINDINGS: The Job Development Laboratory has successfully trained the following rehabilitation personal: i) Texas Institute of Rehabilitation Research in Houston, Texas, ii) The Sheltered Employment Services, Inc., in Philadelphia, Pennsylvania, iii) Lakeshore Rehabilitation Center, Birmingham, Alabama, iv) Maryland Rehabilitation Center, Baltimore, Maryland, v) Valley Workshop, Inc., Waynesboro, Virginia, vi) Infocon Inc., Washington, D.C. and vii) Elwyn Rehabilitation Center, Delaware. A few of these groups have set up their own micrographic shops and are training and hiring handicapped people to do microfilming. Presently, a communication link is being established with representatives of many rehabilitation facilities aimed towards the establishment of training and job placement programs in the area of micrographics. Many rehabilitation professionals and employers, after receiving the complimentary copy of the manual, have indicated that this programmed manual will assist in training and placement of disabled individuals and will thereby help to implement the Affirmative Action Program of hiring the handicapped.

APPLICABILITY: The ultimate aim of the rehabilitation process is job placement. This project provides job development and training in microfilm equipment operations for the severely disabled homebound and non-homebound persons.

208 Comprehensive Evaluation and Treadmill Exercise Testing in Treated Patients for Hypertension

Principal Investigator:	Irene G. Tamagna, M.D.	
FY 1976		
Status:	Continuing	
Dates:	March, 1971-August, 1976	
Cost:	Annual $17,390 RT Annual $8,683	Projected Total $55,000 RT % of Annual Total 50%
Annual Report Reference:	#11, Page 10, R-2	

FY 1977

Status:	**Completed**	
Dates:	**March, 1971-June, 1976**	
Cost:	**Annual 0** **RT Annual 0**	**Projected Total $55,000** **RT % of Annual Total**
Annual Report Reference:	**#12, Page 25, R-2**	

OBJECTIVES:

1. To observe moderately severe hypertensive patients on different medications and to evaluate their systolic and diastolic blood pressure and heart rate response to a measured exercise program.
2. To determine the extent to which a hypertensive patient can engage safely in physical activity and the effectiveness with which therapy protects the patient from excessive blood pressure rise during work or exercise.

METHODOLOGY:

1. This study involves 30 patients with primary hypertension.
2. During Phase I, the 30 hypertensive patients underwent a comprehensive evaluation consisting of a typological analysis of medical, sociopsychological and vocational factors.
3. During Phase II, a new drug, Catapress (imidazolin hydrochloride) was tested with the patient at rest and during a submaximal graded treadmill exercise test.
4. In Phase III, two drugs, Esidrex and Guanethidine, were tested separately and in combination as well as at rest and during exercise training.
5. In Phase IV, another new drug, a beta blocking agent called Oxpropanol, was tested.
6. In all phases the protocol has provided for alternate placebo and an active hypertensive drug treatment period. After each period the patient has undergone a submaximal treadmill exercise test. Laboratory tests have been performed before and after each placebo and drug period. The tests included EKG, CBC, SMA-12, urine and electrolytes. Blood pressure and heart rate readings in sitting and standing position have been taken at weekly intervals.
7. During graded submaximal treadmill exercise, the systolic and diastolic blood pressure and heart rate have been recorded at different exercise levels. Peripheral blood renin activity has been determined before and after exercise in all treatment phases; VMA and urinary catecholamines have been determined only during Phase II.

FINDINGS TO DATE:

1. During FY 1976, a new Beta adrenerigic blocker, oxprenolol, was studied in 30 hypertensive patients at rest and during exercise. Oxprenolol compared to propanolol has additional beta stimulation causing less cardiac depression. Oxprenolol through its effect to block adrenergic beta receptors has been shown to lower elevated blood pressure. Oxprenolol action on hypertension similarly to propanolol, reduces exercise induced tachycardia and increases performance capacity during exercise.
2. Blood Pressure. The average systolic and diastolic blood pressure in sitting position during treatment with Oxprenolol has been reduced minimally when compared to placebo blood pressure levels. In standing, the average blood pressure was slightly higher during treatment as compared to placebo period. Comparing the hypotensive effect of other medication studied on the same patients (such as catapress [imidozoline hydrochloride], guanethidine, esidrix, singularly and combined) oxprenolol, in the dosage administered, is the least effective in reducing blood pressure, demonstrating that beta blocker without diuretics do not reduce blood pressure effectively in moderate to severe hypertensive patients.
3. Blood pressure during general treadmill exercise on Esidrix, guanethidine, combined therapy and oxprenolol showed a slight increase over the resting levels.
4. Heart rate was noted to increase progressively with graded exercise in all four groups. The guanethidine treated group had the highest increase of heart rate at 5 and 6 mets as compared with the other three treatment groups. The oxprenolol treated group had the least increase of heartrate during exercise.
5. During resting period on placebo and on medication one patient had an ST depression of 1.5 mm while on the combined medication and on guanethidine alone. No ST depression were noted in the oxprenolol treated patients.
6. None of the patients developed arrhythmia during the placebo or treatment periods on exercise, except for occasional premature ventricular contractions in three patients on placebo and in two patients on esidrix therapy. No arrhythmia developed in the oxprenolol treated group.

7. After exercise mean plasma renin activities rose during placebo and on each different treatment period, except with propanolol. The greatest difference between pre- and post-exercise in plasma renin activity occurred during the combined guanethidine and esidrix treatment period. The least difference was noted during the catapress period. Proprenalol, a beta blocker, in dosage used in this study did reduce renin levels significantly after exercise when compared to renin levels during placebo medication.
8. Phase V was designed to test the combination of Oxipropanolol, a beta blocker tested in Phase IV, with a diuretic to evaluate the effect of these drugs in reducing blood pressure at rest and during exercise. Oxipropanolol has been withdrawn from the market because of reported side reactions encountered in its use, and therefore was not available for this research purpose. This study has been concluded at the end of Phase IV.

209 Explore Means of Utilizing the Severely Disabled Homebound to Pool Rehabilitation Services Data

Principal Investigator:	K. Mallik, M.Tech., M.S., D. Engr.	
FY 1976		
Status:	Completed	
Dates:	September, 1974-February, 1976	
Cost:	Annual $8,162 RT Annual $7,481	Projected Total $16,659 RT % of Annual Total 92%
Annual Report Reference:	#11, Page 117, SR-3	

OBJECTIVES:

1. To explore the methodology of developing a systems approach to the pooling of data about rehabilitation services and the disabled population being serviced by rehabilitation programs on a state, regional and federal basis;
2. To utilize the capability of severely disabled homebound persons as trainees and prospective employees.

METHODOLOGY:

1. An educational programmer will develop materials for a training program in remote data entry for the severely disabled homebound individual.
2. The client who is evaluated to have the appropriate aptitude will begin training at home.
3. Having successfully completed training in remote data entry, the client will receive from the Rehabilitation Services Administration, grant management information to fulfill on-the-job training.
4. After achieving the necessary competency, the client will demonstrate the feasibility of a homebound client pooling grant management data in computer files.

PROGRESS AND FINDINGS: An instructional manual for data entry is being developed. A few severely disabled people learned the data entry technique using the instructional manual and through on-the-job training. Persons successfully completing the training are now gainfully employed in homebound and on-site jobs.

APPLICABILITY: The crucial aspect of the rehabilitation process is job placement. This project provides training in data entry operations and job opportunity for homebound persons.

210 Multimedia Rehabilitation Resource Center Project

Principal Investigator:	Nina Matheson, M.L.S.	
FY 1976		
Status:	Completed	
Dates:	November, 1974-June, 1975	
Cost:	Annual $39,845 RT Annual $29,400	Projected Total $60,000 RT % of Annual Total 74%
Annual Report Reference:	#11, Page 128, SR-5	

OBJECTIVES:

1. To identify the RSA user groups and to assess their information needs;
2. to identify available resources and existing information systems as well as barriers to their effective use by RSA user groups;
3. to determine alternative configurations for a rehabilitation resource center which can meet the expressed needs of its projected users and which takes into consideration the available resources.

The overall goal of the project was to describe how information delivery to the rehabilitation community could be improved towards the ultimate goal of increasing the effectiveness of rehabilitation programs for the physically and socially disabled.

METHODOLOGY: The literature was examined to identify existing relevant information resources and previous research concerning information needs in rehabilitation, to isolate related studies and to identify models of information delivery and key personnel involved in the information provision in the rehab field. Structured interviews were conducted with a cross-section of potential users of a national center from various segments of the rehab community. A survey of existing resource centers was undertaken. Another data collection method used was a think-tank or brain-storming session in which some key information providers participated. The data from these various sources were synthesized in terms of information needs of five potential user groups: administrators, practitioners, researchers, handicapped individuals and the general public. Existing needs were matched against existing resources, and those unmet needs which could most effectively be met at a national level were selected for incorporation in the recommendations concerning services to be provided by a national center. Service programs were designed to meet those needs at the national level and implementation requirements were defined.

PROGRESS AND FINDINGS: The principal unmet needs which emerged from the study were of two kinds: 1) needs for specific, direct, personal services not currently provided to certain user groups, and 2) needs for general improvements in the current pattern of information delivery. The major recommendation of the study is the establishment of a National Rehabilitation Information Center (NARIC) to include materials in all media. The project suggests three direct services to be undertaken initially. It is recommended that the National Center: 1) assemble, maintain, and provide access to a definitive collection of RSA generated materials to anyone requesting them; 2) provide a rapid, fact retrieval service for rehab administrators at all levels in the government and in the private sector; 3) develop information products tailored to the needs of Washington-based RSA administrators with a view to subsequent repackaging to reach a wider public.

The study also recommends that RSA encourage the formalization of a Rehabilitation Information Network composed of information facilities which it currently funds. The National Center would be charged with the task of organizing the Network and coordinating its ongoing activities. Network objectives would include: 1) coordination of existing services; 2) continuous identification of unmet information needs; 3) promotion of user awareness; 4) improvement of information skills.

APPLICABILITY: Establishment of the National Center would provide an important and needed rehabilitation information resource and services not currently available. The Center in its capacity as Network catalyst would acct to minimize duplication and make maximum effective use of existing information services available to the rehabilitation community.

211 Rehabilitation Training Materials Study

Principal Investigator:	Nina Matheson, M.L.S.	
FY 1976		
Status:	Completed	
Dates:	July, 1975-December, 1975	
Cost:	Annual $35,705 RT Annual $28,340	Projected Total $35,705 RT % of Annual Total 79%
Annual Report Reference:	#11, Page 131, SR-5a	

OBJECTIVES: The objective of the study is to make recommendations to RSA as to how the identification and dissemination of rehabilitation training materials can be most effectively achieved.

METHODOLOGY: Several tasks were undertaken in the attempt to formulate an overall view of actual activities in training material accessibility, production, and distribution that are currently taking place throughout the country.

1. The literature was examined for items indicating centers of training material production and distribution.
2. Selected members of the rehab field whose experience and expertise in training material use or development had been demonstrated were interviewed.
3. Selected sites were visited in order to speak with developers and users at greater length.

FINDINGS TO DATE: The literature was examined to identify sources active in the development of training materials. An interview guide was prepared which served to list the types of questions which would provide the necessary information upon which to base the study recommendations. Information related to the use, production, announcement and distribution of training materials collected from the viewpoints of users and developers was sought. The data was collected from all R&T Centers, all regional Continuing Education Programs and 1 to 2 State agencies in each of the ten regions. Organizations in the private sector with active training programs were also investigated.

APPLICABILITY: Project objectives are directly supportive of the RSA training program. Project generated information and recommendations will facilitate access to material supporting the training of rehabilitation personnel. By contributing to training efforts, the project will have an indirect impact in the improvement of the quality of rehabilitation service.

212 Opening Science Careers to the Handicapped

(SUBCONTRACTOR: The American Association for the Advancement of Science)

Principal Investigator:	K. Mallik, M.Tech., M.S.	
FY 1976		
Status:	Completed	
Dates:	July, 1975-February, 1976	
Cost:	Annual $32,719 RT Annual $32,000	Projected Total 32,000 RT % of Annual Total 98%
Annual Report Reference:	#11, Page 142, SR-7	

OBJECTIVES:

1. To develop and test methods to overcome physical and communication barriers that prevent handicapped scientists from participating fully in professional meetings.
2. To develop and test methods of increasing the awareness of all U.S. scientific professional associations of the educational and career-related needs of their handicapped members.
3. To develop program ideas through which AAAS and other scientific societies may enhance educational and occupational opportunity and equality for the handicapped.

METHODOLOGY: The staff of the Office of Opportunities in Science in consultation with the project advisory group undertook the following activities: 1) Made the American Association for the Advancement of Science meeting in Boston, Feb. 18-24, 1976, accessible to the physically handicapped and prepared a professional meetings accessibility guide for distribution to the 291 AAAS affiliate professional societies and academies and to hotels in major convention cities. In addition to funding from RSA this was made possible in part through contributions from the Exxon Corporation and the DuPont Company. 2) Arranged activities at the AAAS Annual Meeting to focus the attention of the science community on the handicapped: a symposium "Science, Technology and the Handicapped"; an information center and exhibits on the handicapped in science; a luncheon and press conference; and a reception for symposium participants, other scientists, local rehab agency personnel and others. 3) Identified 500 handicapped scientists to serve as a resource group to guide further program development, assist in dissemination of information, and form a support system for handicapped students and peers; 4) Surveyed the various organizations and government agencies of and for the handicapped, and the scientific professional associations for their suggestions as to the educational and occupational barriers; 5) Disseminated information to the general public and scientific community on AAAS project activities and other issues of concern to the handicapped.

FINDINGS TO DATE: The following activities were undertaken from Nov. 1975 through Nov. 1976:

1. Identification of Disabled Scientists and Formation of Resource Group.
2. Science Education Survey: In response to the assessment of needs discovered in the preliminary survey, a project was developed that addresses these needs, "Science Education for the Handicapped: An Inventory of Human and Material Resources". From this effort, two publications will result: **"An Inventory of Experiences: Approaches that Work"**, a catalogue of successful classroom experiences, and **"A Directory of Human Resources"**, a roster of experienced individuals who are willing to help other teachers.
3. Barrier-Free Meeting Project: The AAAS has published **Barrier-Free Meetings: A Guide for Professional Associations.** (available through AAAS Publications Office)
4. AAAS Annual Meeting Activities: A Symposium, "Science, Technology and the Handicapped"; 14 demonstration booths as part of the Science International exposition at the AAAS meeting; a luncheon, "A Natural Partnership"; a breakfast, "Rehabilitation Research on Disability: New Horizons"; a news conference planning meeting and reception; a publication, **Science, Technology and the Handicapped,** which contains proceedings of the symposium, luncheon and breakfast speeches, report of the planning meeting, a list of exhibits, and a description of the Project on the Handicapped in Science (available from the AAAS Office of Opportunities in Science).
5. Interaction with Organizations of and for the Handicapped, Government Agencies, Professional Scientific Societies, and the Congress.

APPLICABILITY: Most rehabilitation training has been at the vocational/manual level or slightly above. Many handicapped persons are capable of being trained beyond these levels, but traditional programs have not maximized their potential either intellectually or physically. There is a role for professional associations in the removal of occupational barriers to handicapped scientists and this project has designed specific programs for the AAAS and other scientific societies to remove occupational barriers to careers in science for the handicapped. Project staff in cooperation with their advisors have assessed a variety of possible activities aimed at increasing occupational opportunities for the handicapped, defined an appropriate role for the professional association in the achievement of equal opportunity for the handicapped in science careers, and organized a new effort in this area that has become an influential component of the AAAS. Scientific professional associations have been made aware of the problems of handicapped scientists and of the societies' role in overcoming barriers, and have been provided with information enabling them to take the first corrective steps. The handicapped and their organizations at the same time have been made aware of how they can use their professional associations for achievement of equal educational and occupational opportunities in the sciences. It is expected that each type of group, as it becomes more aware of the potential of the other, will become more effective in overcoming occupational barriers to the handicapped. Broad dissemination of information has resulted in increased awareness and understanding of the disabled by the scientific community, and increased awareness for the disabled of opportunities available for participation in science careers and professional activities.

213 Live Adjustment Post Myocardial Infarction: Defining Predictive Variables (Former Title: Psycho Social Aspects of Coronary Rehabilitation; Life Adjustment Post Myocardial Infarction: Defining Predictive Variables)

Principal Investigator	Melvin J. Stern, M.D.	
FY 1976		
Status	Continuing	
Dates	March, 1974-September, 1976	
Cost	Annual $34,323 RT Annual $24,916	Projected Total $75,000 RT % of Annual Total 73%
Annual Report Reference	#11, Page 39, R-35	

FY 1977

Status:	**Completed**	
Dates:	**March, 1974-September, 1976**	
Cost:	**Annual $26,834**	**Projected Total $75,000**
	RT Annual $20,699	**RT % of Annual Total 77%**
Annual Report Reference:	**#12, Page 92, R-35**	

OBJECTIVES: To study the psychosocial adaptation of patients who have suffered a myocardial infarction; to relate psychosocial profile with rehabilitation potential and to devise methods for ensuring more effective adherence to medical treatment regimen.

METHODOLOGY: Sixty-eight patients under 70 years of age were first interviewed in the Coronary Care Unit and Sociodemographic information obtained. Subsequent interviews were conducted at a later point in the hospital stay; then, at six weeks, three months, six months and one year post infarction. All interviews were designed to obtain information about the patient's psychological state and his/her rehabilitation progress. Work, family, sexual and social activities were specifically explored and scored. The presence or absence of depression and anxiety were evaluated using the Zung Self-Rating Depression Scale and the Taylor Manifest Anxiety Scale. Denial was assessed based on the interview questionnaire designed and validated by Hackett and Cassem. Three categories of denier were defined (major, mild and minor). A 'major denier' was one who not only was not apprehensive or tense prior to hospitalization and in the Coronary Care Unit but also denied anxiety during any previous life endangering situations. Mild and minor deniers experienced tension to varying degrees during their coronary episodes as well as in previous situations. Other questionnaires administered included: (1) **The Jenkins Activity Scale,** the Rotter Scale and The Peel Index. Recurrent signs and symptoms experienced by patients in-hospital and during follow up interviews were studied. Presence of angina, congestive heart failure, and recurrent infarct or other cardiovascular events were specifically monitored.

FINDINGS TO DATE: This study amplifies a previous pilot study in which two groups of post-MI patients at opposite ends of the rehabilitation spectrum were identified after their first out-patient visit, six weeks post infarct. The depressed patients who continued to function as poor responders generally withdrew from social relationships and became preoccupied with the state of their physical well-being. A significant percentage retired from work and/or failed to return to previous levels of sexual functioning. The deniers continued to function as good responders although, in contrast with the pilot study, they were not significantly differentiated from the general non-depressed patient population who also had good outcomes. Few patients in either the denier or non-depressive group required hospitalization for cardiac complaints. Four-fifths were at work and/or had returned to previous sexual functioning by one year. A possible explanation for the increased level of return to function versus the previous study may lie in the fact that patients in this study participated in an education program which endorsed early mobilization and was actively supported by the physician community.

A new and challenging finding—only marginally present in the pilot—was that the 13 women infarct patients had poor rehabilitation outcomes. Half died and the remainder, with one exception, were hospitalized with some cardiovascular complication. Anxiety and/or depression were present in 80% and over half did not return to work and/or previous levels of sexual functioning.

A possible explanation for the finding with women relates to the specific psychosocial pattern of these women. As a group, they demonstrated a high degree of Type A behavior. They were ambitious and competitive and frequently found themselves racing the clock to handle both work and family problems. Many of their goals were job related, and intrapersonal tensions were frequently displaced into the work arena. Having an infarct upset their entire defensive equilibrium. By being slowed down and unable to dispel tension by frenetic activity these women were forced to confront personal problems previously sublimated or denied. For those who were unmarried, the added stress may have contributed to their demise. This was also obvious in those cases where husbands assumed an overprotective role--forbidding their wives to do even light housework and denying them sex, in the mistaken belief that they were staving off serious medical problems thereby.

APPLICABILITY: Identification of patients with poor rehabilitation potential can be identified early in their post hospital recovery. This makes possible the applicability of providing early treatment to avoid a chronic downhill course.

214 Family Factors in the Recurrence and Maintenance of Alcoholism and Other Chronic Disabilities (Former Title: Alcohol Abuse and the Family)

Principal Investigator:	Steven J. Wolin, M.D.	
FY 1976		
Status:	Continuing	
Dates:	July, 1973-September, 1977	
Cost:	Annual $35,211 RT Annual $26,007	Projected Total $75,000 RT % of Annual Total 74%
Annual Report Reference:	#11, Page 45, R-37	
FY 1977		
Status:	**Completed**	
Dates:	**July, 1973-September, 1977**	
Cost:	**Annual $107,155** **RT Annual $29,189**	**Projected Total $250,000** **RT % of Annual Total 27%**
Annual Report Reference:	**#12, Page 106, R-37**	

OBJECTIVES: The objective of our initial study has been to distinguish two groups of families—those who transmit problem drinking and those who do not—based on a specific factor in the internal life of those families. The transmitter group of families is characterized by alcohol abuse in both parental and offspring generations; the non-transmitter families by such drinking only in the parent generation.

The factor under study is designated the "subsumptiveness of alcohol abuse rituals in family life." This is defined as the extent to which specific interactional behaviors (rituals) and family legends (myths) involving alcohol abuse have been incorporated, or **subsumed,** into normal patterns of daily life. In those families where incorporation has occurred we have hypothesized that a greater frequency of alcohol abuse transmission would occur into the children's generation than in those families where alcohol abuse remained distinctive, that is, outside the normal rituals and myths of the family.

The initial project has produced preliminary data which is very promising. Although our findings are thus far extrapolated from interview data reduction, it is clear that transmitter families are different from non-transmitters with regard to the interior life of the origin family, along the lines that we have suggested by the subsumption-distinctive variable. These tentative first findings, based upon the first nineteen families studied, show an unmistakable preponderance of ritual behavior around alcohol abuse during the children's growth years in the transmitter families distinguishing them as a group from the non-transmitter families.

METHODOLOGY: In this section we will describe the proposed extension of this intergeneration Research technique, the Pilot Stroke Study Phase. We will review the anticipated subject population, instruments to be piloted for feasibility and appropriateness, and the likely methods of data analysis for the forthcoming work.

The new phase might well be labeled "An investigation of family barriers to the optimum rehabilitation of the stroke victim." The family factors under investigation can be divided into two categories — 1) factors which emerge from the family's **past history** and predetermine the patient's progress, and 2) factors which emerge from the family's **current interactional patterns** which provide a similar psychosocial barrier.

The study will collect data in these two areas using separate instruments. At their completion the data will be combined to provide a comprehensive and reliable assessment of the relations between the CVA patient and his/her family environment. As these psychosocial barriers are isolated and correlated with actual rehabilitation efforts high risk families will benefit from the specific family focus provided by our approach.

FINDINGS TO DATE: The data presented in this progress report represents our current findings from the first nineteen families whose interviews were completed by August 1976. In ten of those nineteen families either a child or a spouse of a child has developed a heavy or problem drinking pattern. Those ten families comprise the transmitter group and will be compared with the nine families in the non-transmitter families.

Table 1

DRINKING PATTERNS OF OFFSPRING GENERATION IN TRANSMITTER FAMILIES (Families 1-19)

	Transmitter Families
Number of Problem Drinkers	2
Mean Age of Problem Drinkers	33.5
Number of Heavy drinkers	7
Mean Age of Heavy Drinkers	24
Number Married to Problem Drinkers	2
Mean Age of Spouse of Problem Drinker	26

To rule out the possibility of selective bias, transmitter and non-transmitter families were compared on demographic variables. Chi-square tests revealed no significant differences between groups in education, occupation, ethnic identification or religion of the parents. T-Tests of the mean ages of transmitter fathers indicated no significant differences.

A family by family tabulation was made of those areas of family life which included alcohol abuse rituals and those that did not. Six areas were examined: dinner time, holidays, evenings and weekends, vacations, visitors in the home, and discipline (conforming to those family life areas covered in the second interview). All those families who had either none or one area of family life represented by alcohol abuse rituals were categorized as **distinctive** and all those who had two through six areas represented were **subsumptive.**

The next step was to determine the number of families in each origin family type category that were transmitter families and the number that were non-transmitter families. Out of the six families that were distinctive, only one was a transmitter family (having a heavy drinking offspring) and five were non-transmitter families. In contrast, nine of the thirteen subsumptive families were also transmitter families while four were not. Of the nine transmitter families that were also subsumptive, two had a problem drinking offspring; two had offspring who had married a problem drinker; and six had a child who was a heavy drinker. One family included both an offpsring who had an alcoholic spouse and a heavy drinking child. The relationship between the number of subsumptive and distinctive families and the number of transmitter and non-transmitter families is indicated in **Table 7.**

Table 7

NUMBER OF TRANSMITTER AND NON-TRANSMITTER FAMILIES, BY ORIGIN FAMILY TYPE

Origin Family Type	Transmitter Families	Non-Transmitter Families	Totals
Distinctive	1	5	6
Subsumptive	9	4	13
TOTALS	10	9	19

The subdivision of the 19 families into these four possible categories according to origin family type and transmission/non-transmission of alcoholism has permitted us to ask the question of whether transmission was independent of the family type variable—distinctive or subsumptive. Our null hypothesis was that their transmission of alcoholism from one generation to the next is independent of origin family type. We performed the Fisher's exact test of significance on the 19 families and found that we could reject the null hypothesis at the .0495 level of significance.

APPLICABILITY: In this project, we are concerned with identifying those family factors involved in the maintenance and recurrence of chronic disease processes and their accompanying disabilities in families. Using our established methods we intend to study patients recovering from selected illnesses where chronicity is likely and severe disability possible.

We understand that the family plays a critical role in determining the success or failure in the treatment process, as well as the more direct process of sabotaging institutional objectives (see the work of Dr. Reiss, in report no. 220). We intend to utilize our findings, as the specific data is analyzed, in the more general understanding of the effect of the family in a wide variety of rehabilitation settings. Training projects towards that end are in the discussion phase at the present time.

215 PROJECT ACCESS

Principal Investigator:	Donald E. Hawkins, Ed. D.	
FY 1976		
Status:	Continuing	
Dates:	September, 1974-June, 1977	
Cost:	Annual $26,520 RT Annual $25,000	Projected Total $200,000 RT % of Annual Total 98%
Annual Report Reference:	#11, Page 134, SR-6	
FY 1977		
Principal Investigator:	**Alvin P. Johnson, M.A.**	
Status:	**Continuing (Inactive during FY 1977)**	
Dates:	**September, 1974-February, 1978**	
Cost:	**Annual 0** **RT Annual 0**	**Projected Total $200,000** **RT % of Annual Total 0**
Annual Report Reference:	**#12, Page 162, SR-6**	

OBJECTIVES:

1. To establish and demonstrate the effectiveness of an accessibility advocacy within the structure of a city space VR agency, with the function of representing the accessibility interests of the VR client to both government and private sectors.
2. To determine and demonstrate with actual building(s) and transportation systems, realistic, low cost approaches to utilizing accessibility technology which can be drawn from existing city resources.
3. To develop and establish ongoing consumer input mechanism providing a consumer voice on accessibility issues.
4. To develop and establish a community resource supported, continuous mechanism of identifying accessible buildings and transportation systems.
5. To develop a realistic, long-range city-wide accessibility strategy and implementation plan.
6. To document processes and results of the advocacy for dissemination to other VR agencies for possible adoption into the existing agency structures.

METHODOLOGY: Within the goals and scope of Project Access, the Department of Human Resources of the District of Columbia Government serves as subcontractor to RT-9. A staff of three is proposed to consist of a Project Coordinator, Architectural Specialist, and an Administrative Assistant to provide full time presence and technical authority to deal with accessibility problems. The accessibility advocacy will be located under the direct administrative control of the Chief of the Bureau of Rehab. Services with operational responsibilities to the Mayor's Committee on the Handicapped.

Selected building sites will be identified and modified to serve as live models for what can be accomplished. Emphasis on this demonstration will be placed on selection of areas where relatively simple, low-cost modifications will result in accessibility. Impact studies will be conducted to assess the vocational employment impact of the modifications. This data will be utilized in developing cost benefit rationale for barrier removal.

A transportation accessibility project(s) will also be initiated to demonstrate the utility and cost benefit of existing system adjustments. Impact studies will also be conducted. Selection of these target projects will be based on their visibility and potential to enhance vocational opportunities.

Using existing disabled consumer organizational structures, the accessibility advocate will attempt to develop a formalized linkage between consumer and the city government by creating a permanent, executive level forum through which the disabled themselves can function as a monitoring group.

A printing of a revised, second edition of the guidebook, **Access Washington,** is planned. Since this kind of book is in need of constant updating, an attempt will be made to develop an ongoing mechanism for advising the community of accessible facilities. The accessibility advocate will develop a comprehensive, realistic long-range plan for accessibility in the city which will serve to prioritize actual projects so that areas with the greatest potential impact are addressed first. The plan should also serve as a coordinating vehicle to prevent counter-productive activity.

Project progress and continuity will be monitored by a select committee chosen by the Chief of Special Centers, RSA, and chaired by him. The committee will meet at least quarterly to review progress and evaluate performance. A formal written interim progress report will be delivered at each meeting for review by the committee.

FINDINGS TO DATE: The guidebook, **Access Washington,** was published in February, 1976. The initial printing amounted to 10,000 copies, of which nearly all have been distributed. Plans are being formulated for a revised second edition and a printing of another 10,000 copies.

Project staff designed and produced a brochure to create visibility for the project and availability of resources, expertise and technical assistance to individuals, consumer groups and federal agencies interested in environmental free architecture and assistance in hiring the handicapped.

Due to difficulties in hiring staff for the District of Columbia Government subcontract, Project Access was inactive during part of Fiscal 1976 and during part of Fiscal 1977. Staffing was completed and the project reactivated, effective 3/01/77.

A revised plan was completed and project staff informed. The submitted plan was accepted by the Department of HEW, Rehabilitation Services Administration, and The George Washington University. Based on this, DHEW/RSA has authorized continuation of the project.

APPLICABILITY: Success in vocational rehabilitation can often be denied through lack of accessibility. The problem of accessibility is well recognized and documented in the rehabilitation community. For the District of Columbia Bureau of Rehab. Services, it is a crucial issue. This project will attempt to address the social, economic, attitudinal and legal barriers that inhibit the implementation of accessibility in the District of Columbia.

Vocational, social and psychological rehabilitation will be enhanced and hastened if the primary goals of this project can be achieved. The identification and removal of architectural barriers along with availability of a comprehensive guide to accessible facilities will open new horizons for persons formerly restricted in their activities.

216 Study of Emotional Forces in Psychogenic Asthma

Principal Investigator:	Halla Brown, M.D.	
FY 1976		
Status:	Continuing	
Dates:	December, 1970-March, 1978	
Cost:	Annual $2,938 RT Annual $438	Projected Total $30,000 RT % of Annual Total 15%
Annual Report Reference:	#11, Page 23, R-26	
FY 1977		
Status:	**Continuing**	
Dates:	**December, 1970-March, 1978**	
Cost:	**Annual $3,256** **RT Annual $506**	**Projected Total $30,000** **RT % of Annual Total 16%**
Annual Report Reference:	**#12, Page 89, R-26**	

OBJECTIVES: The purpose of this project is to study the emotional forces in psychogenic asthma to determine if the patient can learn to control these forces and therefore his/her asthma, thereby enabling him/her to return to work. Since there has been unexpected success in this aim in the treatment modality of group therapy, a further objective is to verify these results and write a series of papers on the methods we have used.

METHODOLOGY: Group psychotherapeutic sessions are held once weekly preceded by a conference of the research personnel in addition to two or three medical students in rotational assignment to liaison psychiatry. Two group members are black women from the ghetto, two are women from India attending sporadically with their husbands, two are white women and one is Puerto Rican. An increasingly valuable change in the group process is the regular attendance of the husbands of group members, since it often dramatically highlights the psychodynamic processes characteristic of the asthmatic patient.

Each patient has received a thorough diagnostic workup and is categorized as having infective, and/or allergic, and/or psychogenic asthma, usually all three types. All the usual therapy is given as indicated but no sedatives or tranquilizers are given regularly.

Each patient is urged to attend regularly to reveal him or herself emotionally and in the intimate details of his/her life. Although much practical advice is sought and given by all group members, such as how to reach the welfare supervisor or get an alcoholic spouse into treatment, the main focus is upon effective confrontation and the reduction of ineffective defenses such as accusatory assault, violence and emotional internalization.

The medical students on liaison psychiatry have made occasional home visits in obtaining information for diagnostic evaluation.

FINDINGS TO DATE: The core process in the asthmatic group is the gradual accumulation of shared knowledge of problems involved in effective confrontation. The group explicitly discusses ineffective defense processes, such as verbal accusatory assaults, violence, internalization of anger with depression or asthma. Evidence accumulates that more severe schizoid pathology obstructs improvement in asthma.

APPLICABILITY: Methodology will be developed to teach patients to control emotional forces and therefore his/her asthma.

217 Study of Cortical Organization Using Visual and Somatosensory Evoked Potentials

Principal Investigator:	Robert A. Lavine, Ph. D.	
FY 1976		
Status:	Continuing	
Dates:	March, 1972-December, 1978	
Cost:	Annual $30,674 RT Annual $20,088	Projected Total $70,000 RT % of Annual Total 65%
Annual Report Reference:	#11, Page 34, R-34	
FY 1977		
Status:	**Continuing**	
Dates:	**March, 1972-December, 1978**	
Cost:	**Annual $30,742** **RT Annual $18,787**	**Projected Total –** **RT % of Annual Total 61%**
Annual Report Reference:	**#12, Page 45, R-34**	

OBJECTIVES:

Part I – To determine if evoked response procedures could provide a reliable correlate of linguistic processing and a possible index of cerebral damage leading to language pathology.

Part II – To develop an average evoked response measure to serve as a prognostic and diagnostic tool in measuring neurological change in patients suffering from brain damage, particularly cerebrovascular accident.

METHODOLOGY:

Part I

1. While seated in a dark, electrically and acoustically shielded room, volunteers (normal controls and aphasic subjects) were presented with visual stimuli in the form of 16 common three-letter nouns and 16 scrambled dot patterns on an oscilloscope screen. A computer controlled the stimulus presentation while recording and averaging the evoked responses from the electroencephalogram (EEG). EEG electrodes were placed according to the International 10-20 system over parietal (P_3P_4) and accipital cortex (O_1O_2).
2. Subjects were encouraged to read and remember both the words and the dot patterns. They were then shown 256 word and 256 dot stimuli intermixed at a rate of 1 per second, each lasting 40 msec.
3. Artifact contamination was presented by visual monitoring of the EEG and interruption of the test when artifacts appeared. The subject could also interrupt the test if necessary by tapping on an intercom.
4. Following the testing, all responses were catalogued on computer tape for future retrieval and statistical analysis. Latency and amplitude measures of positive and negative peaks were analyzed primarily by paired t-tests and analysis of variance.

Part II

1. Methods in Part II vary from Part I only in stimuli presented and electrode placement. The somatosensory system is stimulated by electrodes placed on the wrist to activate the median nerve, or by a mechanical probe tapping the fingertip. Responses are recorded over the cervical vertebra to record spinal responses and on the scalp over somatosensory cortex.

FINDINGS TO DATE:

Part I

1. Part I of this project was an investigation of AERs to linguistic and non-linguistic stimuli in aphasei and normal subjects. This has been completed.
2. Our main positive findings concern peak N, a negative deliflection between 100 and 200 MSEC following stimulus onset in the right and left occipital lobes. The results suggest that this peak may be (a) associated with language processing in normal subjects and (2) altered in left hemisphere damage resulting in aphasia.

Part II

1. Collection of kaseline data on the somatosensory response in 14 normal adult subjects and 2 children.
2. A computer program has been designed to give a printout of the evoked response for each subject. Specific peaks are being compared across subjects, stimulus type and electrode placement. Statistical analysis will follow on these and approximately 10 more subjects to determine baseline information on evoked response waveforms, spinalcortical delays, and apparent CNS conduction velocities in normal subjects and in patients with right or left hemisphere damage resulting from CVAs.
3. Plans are now being activated to test stroke patients in their hospital rooms during the course of their recovery using a portable signal averager (Nicolet + CA/000). This data will be correlated with EMI scan information.

APPLICABILITY: The results of this project should determine if averaged evoked response (AER) procedures can provide a reliable diagnostic tool in cases of neurological impairment due to stroke. AER procedures could be used not only to help predict degree of recovery, but to monitor changes in cerebral activity as functional recovery is made during the course of rehabilitation. Such a direct measure of cortical behavior, independent of behavioral responses, would be valuable in assessing effectiveness of a given rehabilitation effort and could help to determine long-term goals for the patient particularly in cases in which the patient's behavior is too limited to accurately reflect cerebral activity as in aphasic or recently damaged stroke victims.

218 Job Development and Enhanced Productivity for Severely Disabled

Principal Investigator	K. Mallik, M.Tech., M.S., D. Engr.	
FY 1976		
Status	Continuing	
Dates	September, 1974-September, 1977	
Cost	Annual $70,136 RT Annual $56,036	Projected Total 360,000 RT % of Annual Total 80%
Annual Report Reference	#11, Page 80, SR-2	
FY 1977		
Status:	**Continuing**	
Dates:	**Sept., 1974-September, 1977**	
Cost:	**Annual $101,711** **RT Annual $77,817**	**Projected Total $360,000** **RT % of Annual Total 77%**
Annual Report Reference:	**#12, Page 127, SR-2 (R-41)**	

OBJECTIVES:

1. To increase employment and placement of severely handicapped persons by increasing their capacity to perform a wider range of those physical tasks ordinarily associated with information handling jobs;
2. To reduce barriers to employment, lateral and upward mobility, and training for more appropriate and satisfying work, and to reduce the costly restructuring of jobs for the severely disabled;

3. To improve and increase through low-cost technological methodology the productivity, versatility, and adaptability of severely disabled persons presently employed in information jobs or in jobs where information handling is a critical subtask;
4. To insure and enhance job stability by increasing productivity and thereby, to gain a better return of the original rehabilitation investment dollar;
5. To list the job tasks uncovered and to describe their solutions in cost/benefit terms so that general applications can be made to jobs and job groups;
6. To demonstrate the utilization of the project's results through their application to federal government agencies;
7. To advance presently employed severely disabled persons along the employment ladder and to open up jobs in private industry and government.

METHODOLOGY: Following the selection of severely disabled clients, jobs will be selected, developed, and analyzed for the clients. All clients will be evaluated to determine their functional, psychological, and cognitive abilities. Clients and jobs will then be matched and, as necessary, modifications and adaptations in the job and work situation will be made through bioengineering. This will involve the prescription, design, construction, and fitting of adaptive aids and environmental modifications. The productivity of the workers will be analyzed and a cost/benefit study carried out; following this a final report will be released.

FINDINGS TO DATE: Through research and the development of an innovative on-site and homebound placement model, the project has demonstrated the competitive and job productivity capacities of severely disabled persons who, otherwise, are considered infeasible for conventional rehabilitation by state departments of vocational rehabilitation. Preparation of a placement model handbook series is underway.

APPLICABILITY: The research findings indicate that rehabilitation money invested in the job placement process for severely disabled persons are cost-effective and result in competitive earnings for clients and job stability. The project's outcome should influence change of employer's attitudes towards hiring severely disabled persons.

Rehabilitation facilities can utilize these techniques (jobs development, job training, client analysis, job-client matching, job tasks modifications and job re-engineering) to place severely disabled clients. Potential employers can utilize many of these resources to implement the Affirmative Action Program for hiring the disabled.

219 Rehabilitation Potential of Stroke Patients as a Function of Cerebral Lesions, Visualized by Computerized Transaxial Tomography and Cerebral Blood Flow Patterns

Principal Investigator:	G. Molanari, M.D.	
FY 1976		
Status:	Continuing	
Dates:	February, 1975-February, 1978	
Cost:	Annual $11,996 RT Annual $5,986	Projected Total $115,000 RT % of Annual Total 50%
Annual Report Reference:	#11, Page 48, R-44	
FY 1977		
Status:	**Continuing**	
Dates:	**February, 1975-February, 1978**	
Cost:	**Annual $16,842** **RT Annual $7,735**	**Projected Total $115,000** **RT % of Annual Total 46%**
Annual Report Reference:	**#12, Page 50, R-44**	

OBJECTIVES: The objectives of this project are: 1) to assess rehabilitative potential in an objective manner, and 2) to test the value of a neurological-rehabilitative service interface in the achievement of the highest level of functional independence of the stroke patient.

METHODOLOGY:

1. All study patients will have computerized axial tomogram (EMI-Scan) as soon after admission to the unit as permitted by the patient's clinical condition (EMI-scans are non-invasive x-ray tests available only in the radiology suite and not earlier than 24 hours after onset as scans in this early acute stage may be negative.
2. All study patients will have an Electroencephalogram analyzed specifically for generalized (non-specific) slowing as well as focal lesion-specific slow wave activity.
3. Brain Scintillation Scans and cerebral angiography will be obtained as indicated for dianosis only. However, when obtained, these studies will be specifically analyzed for evidence of extracranial and intracranial collateral circulation. Previous reports indicate that strongly positive scintillation scans develop in subacute post-ischemic states as a reaction to ischemic, a phenomenon at least in part dependent upon re-vascularization. In rapid sequence contrast angiograms, retrograde filling of occluded vascular segments, shunting, staining and persistent non-filling in foci of infarction all provide indirect assessment of the quality and quantity of collateral blood flow.

FINDINGS TO DATE:

1. A standardized method has been developed to assess the size of the cerebral ventricles, using computerized axial tomography, a new non-invasive technique. Analysis of a series of 52 computerized axial tomograms (this number includes some normal volunteers as controls) from patients of known age, in three diagnostic categories, indicates that ventricular size increases with advancing age, and that cerebral atrophy can be distinguished from normal variability in ventricular size and from hydrocephalus, using a parameter called the **ventricular ratio,** developed in the RT-9 sponsored protocol. This finding has been independently confirmed in other laboratories.
2. Using this measurement, preliminary data in stroke patients indicate that the outcome and the quality of recovery varies not with the type and location of the focal lesion alone, i.e., the infarct or hemorrhage depicted by the brain scan, but also with the ventricular size. This finding suggests that the functional recovery may be determined or modified not only by the quality and quantitative dimensions of the focal vascular lesion, but also by the quality and quantity of the cerebral substrate in which the stroke lesion occurs. The presence or absence of the pathogenetically independent process of cerebral atrophy and/or previous cerebral infarctions are reflected in ventricular size; and changes produced by coexisting pathologies are within the power of resolution of computerized tomographic scanning equipment at the W.W.U. Medical Center.
3. In our experience, patients over age 65 often show ventricular enlargement in addition to the acute focal cerebrovascular lesion.
4. In cases of **brain hemorrhage,** the initial EMI Scan is most useful and, indeed, uniquely sensitive to even small amounts of intraparenchymal bleeding from other types of pathology. Initial scans often show extensive extrauasation and seepage into the ventricles. However, repeat scans three months later reveal the actual tissue loss to be considerably smaller than the area affected by hermorrhage initially.
5. In cases of ischemic infarction, the initial EMI Scan shows a much larger area of lucency than that shown in repeat scans 3 months later.
6. These findings indicate that while the initial Scan is most useful and necessary for diagnosis and acute medical management, repeat scan at 3 months correlates with the actual amount and locus of tissue loss (encephalomalacia). It is the delayed scan which correlates with residual neurological defects and functional recovery.
7. The computerized axial tomogram (EMI Scan) studiesshow, although statistical significance has not been achieved, that the quality of recovery of neurological function correlates more with the presence or absence of cortical involvement than with the actual size of the lesion.

APPLICABILITY: Successful completion of this study will generate patterns of presentation of stroke syndrome most compatible with favorable recovery, lead to more realistic estimation of rehabilitative objectives and more efficient utilization of rehabilitative resources.

220 The Role of Family in Institutional Rehabilitation of Clients with Behavioral and Physical Disabilities (Former Title: Role of the Family in Institutional Rehabilitation of Patients with Alcoholism, Behavior Disorders, and Delinquency)

Principal Investigator:	David Reiss, M.D.	
FY 1976		
Status:	Continuing	
Dates:	July, 1974-July, 1977	
Cost:	Annual $78,961 RT Annual $60,774	Projected Total $120,000 RT % of Annual Total 77%
Annual Report Reference:	#11, Page 53, R-45	
FY 1977		
Status:	**Continuing**	
Dates:	**July, 1974-July, 1979**	
Cost:	**Annual $66,450** **RT Annual $50,927**	**Projected Total $250,000** **RT % of Annual Total 77%**
Annual Report Reference:	**#12, Page 117, R-45**	

OBJECTIVES: The **behavioral disability** phase seeks to predict rehabilitation outcome of patients with chronic behavioral disability based on characteristics of their families; the **physical disability** phase seeks to make similar predictions for patients with spinal cord injury and stroke.

METHODOLOGY:

1. The behavioral disability phase will use adolescent and young adults (A). The psychiatric patients who lived at home with both parents until hospitalization. All patients will have been admitted to an in-patient psychiatric service for the treatment and rehabilitation of alcohol, drug abuse and delinquency problems. Both parents will be included in the study. Some phases of the study require the professional staff and some administrators in the sponsoring institutions to serve as subjects. The physical disability phase will use 10 spinal cord and 10 stroke patients. All 20 patients will have lived in intact families before being hospitalized. The spinal cord injured patients will be married males with at least one child over the age of 10; the stroke patients will be married males under 65, without significant cognitive impairment and have one unmarried child under the age of 30 living in the vicinity of the patient and available for testing.
2. Family, institutional and treatment processes, and outcome variables will be measured. Included in the variables will be the family's typical orientation to social problems and the particular Q-sort method. A standardized interview and questionnaire will measure structured and multiple family group including communication patterns, seating patterns, sociometric choices, and cohesiveness. Outcome variables will consist of estimates of the patient's overall improvement.

FINDINGS TO DATE:

1. In the behavioral disability phase, findings from 36 families show that laboratory assessment procedures permit families to be grouped into four categories based on the family's orientation towards novel and problematic social situations. This classification accurately predicts many aspects of the family's involvement in the treatment program; the degree to which the family is noticed by staff and other families, the extent to which the family can open itself to new advice and experience (rather than remain closed and self-protective) and the family's morale and sense of optimism about the treatment program.
2. The physical disability phase is just beginning and no data is available.

APPLICABILITY: Results of these studies should help rehabilitation staff to identify problem families within the first week or two of work with patients and their families. In particular, it should help to predict families who will undermine the treatment, simply fall from full attention or drop out of the program prematurely.

221 Factors Influencing Patient Compliance in Patients with Ischemic Heart Disease

Principal Investigator: Jack B. Taylor, M.D.
FY 1976
Status: Continuing
Dates: March, 1974-February, 1977
Cost: Annual $26,410 Projected Total $65,000
RT Annual $18,350 RT % of Annual Total 70%
Annual Report Reference: #11, Page 59, R-46

FY 1977
Principal Investigator: Anne M. Acherman, M.S.N.
Status: Continuing
Dates: March, 1974-February, 1977
Cost: Annual $9,550 Projected Total $65,000
RT Annual $7,826 RT % of Annual Total 82%
Annual Report Reference: #12, Page 28, R-46

OBJECTIVES:

1. To describe to myocardial infarction patients information and attitudes toward their disease and their role in its management.
2. To describe the compliance pattern of these patients with advice concerning diet, medicines and smoking.
3. To compare the relationship between information, attitude and compliance and selected socio-demographic and illness variables.

METHODOLOGY: Seventy (70) sequential patients with myocardial infarctions were selected from patients admitted to the Coronary Care Unit. Race, education, sex and history of previous myocardial infarction were not exclusion criteria. The only patients excluded were those above 70, those with a severe emotional or intellectual impairment and patients who were unavailable for follow-up because of distance. Background information collected on each patient consisted of demographic data (age, sex, race, marital status, education, occupation) and data about their illness (coronary risk factors, location of infarct, peak CPK and SGOT, prior coronary heart disease and recurrent signs and symptoms.) These data were used to derive a Peel Index and an AHA Functional Classification as objective measure of severity of infarction. Information was also collected concerning the number of days patients were in the CCU, any re-admissions to the CCU, and the number of days in the hospital, to see how these variables relate to the patients' perception of the severity of their disease.

While hospitalized, all patients receive standardized information regarding their disease and management from a clinical nurse specialist. This program was in existence prior to the inception of this research study.

Shortly after transfer to the Progressive Care Unit, the patient and family are shown a set of slides depicting a normal cardiac anatomy, coronary atherosclerosis, myocardial injury, and healing. A twenty minute oral presentation explaining the slides is given by the nurse. Pamphlets from the American Heart Association which reinforce this information are given to the patient.

At a following date, risk factors for Coronary Artery Disease are identified by the nurse; patient and family are brought into a discussion of how to modify the risk factors particular to the patient. Information describing the American Heart Association Diet is presented and supplemented with pamphlets, food lists and recipes.

During the next session, the patient and family are shown a twelve-minute movie which depicts a person at home after being discharged from the hospital with a myocardial infarction. The emphasis of instruction is on appropriate convalescent activity. A summary sheet of post-discharge activity is also given to the patient.

Any medications the patient is to take at home are explained to him/her by the nurse, and printed information sheets are given to the patient for reinforcement. Just prior to discharge, after receiving their instructions, the patients are given the information questionnaire and the attitude questionnaire which they fill out as a paper-and-pencil test. Patients who have difficulty reading the questions are assisted by an interviewer, but no information is given regarding the correct response. Patients then return at six weeks, three months, and six months for follow-up questionnaires and interviews to assess their knowledge, attitude and compliance. At six months the spouse also receives a compliance interview as a reliability check on the patients' report of compliance.

FINDINGS TO DATE: Of the 77 patients accessed over the past year, 14 patients have been dropped either for physical or emotional reasons.

Data from the sixty-three patients remaining in the study reveal that fifty-six (56) patients are male, seven (7) are female. Their age ranges from 20-70 with the mean age being 53. The majority of patients are caucasian with only thirteen patients available to study from minority groups. At least half of the sample had a college education or higher so knowledge is expected to be high in this group of patients. There are approximately ten patients who received less than a high school education so it is anticipated they will score low in knowledge. Whether these patients are representative of all patients with myocardial infarction at The George Washington University Hospital is not known because educational level is not routinely recorded in patients' records.

Patients' mean level of knowledge over time was 66% (at discharge); 67% (6 weeks); 68% (3 months) not decreasing over time as originally hypothesized. Mean level of physician knowledge on the patient questionnaire was 87%. Most knowledge deficiencies were in the areas of activity, smoking and blood pressure. Patients more knowledgeable in diet and smoking, complied more with dietary and smoking recommendations than those who scored low in these areas.

The majority of patients felt that modifying their diet, quitting smoking, taking medications are indicated and following an activity schedule prescribed by their doctor were beneficial to them. At six months 10% (6/59) were still unsure they had an MI; 52% (31/59) felt they were susceptible to future attacks but 34% (20/59) felt they had total control over them; 15% (9/59) felt there was nothing they could do to control their chances of having another heart attack. These attitudes did not differentiate the compliers from the non-compliers. Other attitudes not predictive of compliance were those about the worth as well as the effort of controlling blood pressure following a low cholesterol diet, quitting smoking and taking medicine. The majority of the sample felt all these activities were worth it.

Of the smokers, 58% (21/36) did not smoke during the first year. Compliance with diet steadily decreased over the year: 72% (6 weeks); 65% (3 months); 53% (6 months); and 54% at 1 year. Compliance with medications showed no definite pattern ranging from 57% (6 weeks) to 60% (1 year). Medications having the highest rate of non-compliance were nitrates and antihypertensives. Patients who had previous infarcts did not know more or comply more with physicians' recommendations than those patients having their first infarction.

Many patients expressed a need for information and/or support services at discharge (64%); six weeks (72%) and again at three months (65%). The kinds of services patients and spouses thought might be helpful were: hot line telephone, literature by mail, group teaching and individual sessions with an R.N. Areas about which patients wanted more information were activity (62%), what to expect in the future (58%), sex (42%) and explanation of tests done (43%).

Future plans include pooling data from this study with Dr. Melvin Stern's measures on the same patients of their personality and psychosocial adjustment. In this way other influences on knowledge, attitude and compliance may be identified.

APPLICABILITY: After analyzing the data, it is envisioned that a hospital sponsored information support service could be developed and its effect on knowledge, attitude, compliance and psychosocial adjustment of MI patients measured. This support service could take several forms (e.g. a hot line telephone, information sent through the mail, coronary clubs or individual counseling).

222 A Pilot Project: Stroke in the Young

Principal Investigator:	**G. F. Molinari, M.D.**	
FY 1977		
Status:	**New**	
Dates:	**December, 1976-November, 1977**	
Cost:	**Annual $81,364** **RT Annual $66,748**	**Projected Total $81,364** **RT % of Annual Total 82%**
Annual Report Reference:	**#12, Page 56, SR-8**	

OBJECTIVES:

1. Identify objective anatomical, physiological, and neuropsychological variables contributing to the vocational and rehabilitative potential in younger stroke patients.
2. Determine the validity and reliability of the EMI scan, the cortical evoked response, and classical standardized aphasia testing, and quantitative psychological assessments as indicators of the anatomical, physiological, and psychological substrates of vocational rehabilitation.
3. Develop a protocol using the most sensitive, reproducible, and reliable of these parameters for a standard evaluation procedure and progress monitoring tool for rehabilitation programs targeted at vocational and avocational independence.
4. Disseminate the information accumulated in this pilot project on the utility of these "state of the art" parameters in assessment of vocational rehabilitation by offering a seminar on "Anatomical, Physiological, and Psychological Substrates of Vocational Rehabilitation."
5. Publication of a monograph targeted at vocational counselors indicating the utility, desirability, and availability of these parameters in assessment of prognosis and eventual outcome of rehabilitation of the younger stroke patient.

METHODOLOGY:

1. Recruit a qualified junior neurologist as supervisor and coordinator of initial work-up, management, and follow-up of all stroke victims under the age of 55 presenting at the clinics, emergency room, or in-patient services of the G.W.U. Hospital.
2. Data gathered will include (a) basic clinical variables for identification of site and size of neurological insult, including all the clinical signs and symptoms reputed to have prognostic or diagnostic value, and (b) EMI scans, electrophysiological studies (cortical evoked response), speech evaluations or neuropsychological tests as indicated clinically. Test parameters will be collated with clinical signs and symptoms at at least three points in the natural history of each patient's illness: initially, at three months, and at six months.
3. Each patient will have presenting signs and symptoms recorded. An initial EMI scan is routinely performed on all stroke patients entering the G.W.U. Comprehensive Stroke Care program. This has now become a "state of the art" diagnostic service for such stroke patients, and although data obtained from the initial EMI scan may be used in the study, its primary purpose is patient service and is not to be purchased by the research program. A repeat EMI scan will be obtained at three months, which will be obtained for investigational purposes and should be at no expense to the patient. The EMI scan at three months, based on our previous work on this study, will accurately represent the residual lesion itself and is reciprocal, the anatomical substrate for rehabilitation.
4. Cortical evoked responses already in research development, sponsored by the Rehabilitation Research and Training Center, will be at no expense to the patient.
5. In right hemiplegic patients initial evaluation by speech pathologists will be obtained at a point in the course of the illness if and when clinically indicated, and will be considered a patient service to be used in initial diagnosis. Similarly, in left hemiplegic patients, neuropsychological testing, including the specific tests for nondominant hemisphere functioning, will be obtained for diagnostic purposes as a service to patients. Both types of neuropsychological evaluation will be obtained in any individual patient only if there is evidence of bilateral lesions or a history of a previous stroke. However, as an investigational parameter, either the comprehensive speech evaluation or the psychological testing will be repeated at six months for correlation with performance in the vocational rehabilitation program and for correlation with the anatomical and physiological variables obtained earlier in the course.
6. Patients referred from other hospitals directly to the rehabilitative program late in the course of their illness as outpatients will have one each of the following test parameters: (a) EMI scan (if not previously performed and available), (b) auditory/visual and/or somatosensory cortical evoked response, and (c) either speech and language evaluation or comprehensive psychological testing.
7. Based on our analysis of demography in the first nine months of operation of the project "Prognostic Value of Computerized Axialized Tomography in Stroke Patients" a minimum number of thirty patients under the age of 55 will be comprehensively evaluated during this one year project.
8. Based on analysis of the data obtained on these thirty patients in this pilot project, the provisional protocol will be reviewed, the reliability and validity of individual test parameters will be reassessed, and a standard protocol will be developed for trial as a standard clinical tool for quantitative assessment of the anatomical, physiological and psychological substrates of vocational training in younger stroke victims for use in the G.W.U. Rehabilitation Research and Training program and other affiliated comprehensive rehabilitation programs.

9. As little vocational and avocational application of stroke research is presently utilized, and these areas are particularly important to stroke in the young, the Job Development Laboratory's involvement will be directed at this level of stroke rehabilitation. In conjunction with therapy and testing most sensitive and applicable to employability of stroke patients (i.e. speech therapy, activities of daily living, occupational therapy, physical therapy, computerized axial tomography, cortical evoked response, classical standardized aphasia testing, and quantitative psychological assessments). Laboratory staff will utilize supplementary testing to complete the vocational profile. These tests may include perceptual and functional evaluations and pre-vocational testing as necessary. This testing and evaluation battery will be performed with approximately twenty young medically-stable stroke patients through medical referral.

   Integration of medical, therapeutic, and vocational tests, as well as the development of Criteria for interpretation of evaluated results, will form the basis for a quantitative employability system to evaluate client vocational potential.

   Drawing upon the Job Development Laboratory's experiences in the areas of job development, job-task analysis, and job-client matching, target vocational areas will be analyzed relative to levels of cognitive and physical functioning.

   Through correlation of Job Task Analysis and Client Functional Levels, some areas of functional adaptation may be indicated. These may include testing equipment as well as functional aids.

   Subsequent to this first year of research, implementation utilizing the quantitative employability system in a vocational placement setting will be demonstrated contingent on future findings.

FINDINGS TO DATE: New project—not applicable.

APPLICABILITY: Findings from this project will provide treatment regimens for the rehabilitation of this severely disabled group.

223 Clinical Component: Medical Complications of Patients with End Stage Renal Disease (SR-9); Vocational Component: Vocational Barriers to End Stage Renal Disease Patients and Methods for Alleviation (SR-10)

Principal Investigator:	**Alvin E. Parrish, M.D.**	
FY 1977		
Status:	**New**	
Dates:	**December, 1976-November, 1977**	
Cost:	**Annual $105,746** **RT Annual $100,000**	**Projected Total $105,746** **RT % of Annual Total 95%**
Annual Report Reference:	**#12, Page 83, SR-9 SR-10**	

OBJECTIVES:

This project proposes to accomplish the following objectives:

1. To develop an understanding between:
   - The primary disease producing End-Stage Renal Disease.
   - Medical complications associated with hemodialysis.
   - Work tolerance of patients undergoing chronic hemodialysis.
   - Impact of dialyzing schedules and vocational potential.
2. To produce, based on the findings in Objective 1, a protocol for assessing vocational potentials of ESRD clients including strategies for:
   - Restructuring clinical procedures and dialyzing schedules to minimize negative vocational impacts.
   - Job restructuring and modification to accommodate reduced work tolerance and dialysis scheduling problems.
   - Job retraining into vocational fields most suited to the ESRD client population.
3. To conduct a region-wide conference to disseminate project findings to vocational rehabilitation counselors and ESRD clinical personnel.

METHODOLOGY: To accomplish the objectives two teams from the George Washington University will work collaboratively.

The clinical date assessment portion will be conducted by the Division of Renal Diseases, under the direction of Alvin E. Parrish, M.D. The vocational development portion will be conducted by the Job Development Laboratory, Division of Rehabilitation Medicine, under the direction of Kalisankar Mallik, M.S.

Clinical Component:

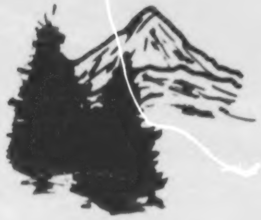
The clinical component will study a group of clients with End-Stage Renal Disease so that factors such as medical complications (frequency and type) can be examined in relation to type of work experience, loss of time from work, setting of dialysis, family support and complicating diseases.

Analysis of this data of patients with End-Stage Renal Disease prior to and since support of End-Stage Renal Disease care through the Medicaid program will pinpoint those areas of significance for the development of a model plan for rehabilitation of clients with End-Stage Renal Disease in an effort to make them more self-supporting and thereby, conserve the costly resources currently being committed.

FINDINGS TO DATE:

Not applicable.

APPLICABILITY: This project should contribute a significant step toward relating the medical factors of ESRD to vocational rehabilitation. Through this information, specific guidelines can be begun which will enable both clinician and counselor to assist the ESRD patient to achieve maximum vocational potential.



University of Colorado (RT-10)
Medical Rehabilitation Research and Training Center

CORE AREA

Cardiopulmonary Rehabilitation

Research undertaken by the Center is practical, patient/client — oriented clinical research that is primarily derived from or utilized in the comprehensive patient care program for both in-patients and out-patients with coronary atherosclerotic heart disease. The coordinated research program dealing with major physiologic and psychologic problems in cardiopulmonary rehabilitation is designed to have a potentially direct impact on the primary or secondary prevention of disease or the prevention or modification of disability due to disease.

UNIVERSITY OF COLORADO

Homer L. Brammell, M.D., Director
University of Colorado Medical
Rehabilitation Research and Training Center
4200 East 9th Avenue, Box C242
Denver, Colorado 80262

PROJECT TITLES BY FY 1977 STATUS

COMPLETED

Abstract No.

The Effect of Postural Drainage on Airway Obstruction (F. Patrick Maloney, M.D.) 224

Serial Investigation of Myocardial Infarction Patients Using Noninvasive Techniques (H. L. Brammell, M.D.) 225

Clinical Application of Computer Scoring System of Electrocardiograms (William Orr, M.S.) 226

The Assessment of Hypoxia and Reduced Ventilitory Drive in Pulmonary Disability (Giles Filley, M.D.) 227

Prognosis in Recovery from Aphasia (Ethel Chang, M.A.) 228

Systems Analysis of the Delivery of Rehabilitation Services in a Rural Setting (Jerome W. Gersten, M.D.) 229

Field Testing of a Cardiac Evaluation Technique for Counselor Use in Vocational Rehabilitation (James W. McDaniel, Ph.D.) 230

Survey of the Rehabilitation and Employment Problems of Hemodialysis Patients (James W. McDaniel, Ph.D.) 231

CONTINUING

Early Adjustment to Steady and Unsteady Exercise in Patients with Cardiopulmonary Disability (H. L. Brammell, M.D.) 232

NEW

Controlled Evaluation of a Comprehensive Rehabilitation Program Immediately Following Acute Coronary Events (H. L. Brammell, M.D.) 233

Echocardiographic Assessment of Ventricular Motion During Exercise (H. L. Brammell, M.D.) 234

Hypoxia and Cognitive Functions in Cardiovascular and Obstructive Pulmonary Disease Patients (James W. McDaniel, Ph.D.) 235

DISCONTINUED 1976

Evaluating a Behavior Therapy Approach for Rehabilitating Patients with Obstructive Pulmonary Disease (Louis Retledge, Ph.D.)

DISCONTINUED 1977

National Exercise and Heart Disease Project (NEHDP) (H. L. Brammell, M.D.)

Motivational Factors in Cardiac Reconditioning (James W. McDaniel, Ph.D.)

PROPOSED

The Sequential Evaluation of Sensitivity and Predictive Accuracy of Treadmill Testing Following Myocardial Infarction (H. L. Brammell, M.D.)

Cardiopulmonary Adjustments of Exercise and Other Stresses (Giles F. Filley, M.D.)

Effects of Physiological Work Loads on Psychomotor Performance (James W. McDaniel, Ph.D.)

The Effect of Low Level Aerobic Conditioning on Exercise Tolerance in Left Ventricular Dysfunction (H. L. Brammell, M.D.)

Functional, Vocational and Psychosocial Evaluation of Post-Cardiac Arrest Patients (H. L. Brammell, M.D.)

224 The Effect of Postural Drainage on Airway Obstruction

Principal Investigator:	F. Patrick Maloney, M.D.	
FY 1976		
Status:	Continuing	
Dates:	January, 1975-November, 1976	
Cost:	Annual $23,392 RT Annual $14,987	Projected Total $51,300 RT % of Annual Total 64%
Annual Report Reference:	#11, Page 47, R-7	
FY 1977		
Status:	**Completed**	
Dates:	**January, 1975-October, 1976**	
Cost:	**Annual $35,497** **RT Annual $27,092**	**Projected Total $51,300** **RT% of Annual Total 76%**
Annual Report Reference:	**#12, Page 25, R-7**	

OBJECTIVES:

1. To study the effect of postural drainage on small airway obstruction as evidenced by changes in objective pulmonary parameters;
2. to substantiate patient's subjective improvement following postural drainage;
3. to observe any changes in small airway obstruction affected by postural drainage.

METHODOLOGY: MMEF, FVC, FEC , and flow volume loops will be used for each patient as per protocol. Sputum will be collected for 24 hour periods and for the period of the study. A questionnaire to assess subjective improvement will be used. Spirometry and flow volume loops will be obtained before postural drainage, and 15-30 minutes following, and three hours following postural drainage on three consecutive days. These will be compared to similar studies done for two days preceding the series of postural drainage and three days after the postural drainage has been discontinued. The spirometric studies will be obtained each day for a second three-day period of postural drainage following the second control days without postural drainage. Each day's studies will provide an opportunity to see immediate or short term effects, and comparisons over the entire eight day period will be used for observations of longer term effects. Daily medications and inhalation therapy will remain the same throughout. Inhalation therapy will use bronchosol for each patient. Sputums will be compared for each period. Daily questions will determine subjective improvement in each patient. The questions are placed on 3x5 cards and shown to subject. This does not prejudice results since no other instruction is given but to choose the statement which is most nearly correct. The answers are in the form of multiple choice covering all possible alternatives to the question.

FINDINGS TO DATE: Fifteen patients were studied, and it was found that some patients improved while others worsened with postural drainage. No significant differences were found between these groups in slow vital capacity, forced vital capacity, forced expiratory volume, airway resistance, or in any other measures made during the study. Further results suggest that "subjective improvement" may be the only benefits attributable to postural drainage.

APPLICABILITY: Postural drainage is probably the most common treatment in physical therapy departments for patients with chronic obstructive airway disease. This treatment is a common adjunct to other medical management for thousands of people and involves considerable expense, although there is little objective evidence to support its use.

225 Serial Investigation of Myocardial Infarction Patients Using Non-Invasive Techniques

Principal Investigator:	H. L. Brammell, M.D.	
FY 1976		
Status:	Continuing	
Dates:	July, 1971-Open-ended	
Cost:	Annual $19,545 RT Annual $15,585	Projected Total unknown RT % of Annual Total 80%
Annual Report Reference:	#11, Page 52, R-157	
FY 1977		
Status:	**Completed**	
Dates:	**July, 1971-June, 1976**	
Cost:	**Annual $19,545** **RT Annual $15,585**	**Projected Total –** **RT % of Annual Total 80%**
Annual Report Reference:	**#12, Page 36, R-157**	

OBJECTIVES:

This study evaluated graded exercise testing to determine its safety and value in patient management.

a. To institute and refine a program of post myocardial reconditioning that serves the patients of the medical community of the University of Colorado Medical Center and serves as a model for programs in smaller communities.

b. To utilize non-invasive methods of evaluating cardiac function in an attempt to determine the best candidates for reconditioning and to evaluate the results of that effort on cardiovascular function.

c. To evaluate the efficacy of a minimally supervised program of physical reconditioning.

METHODOLOGY: Three hundred forty six graded exercise tests were performed on 111 patients within 14 weeks after 120 myocardial infarctions.

FINDINGS TO DATE: Review of the treadmill exercise studies has suggested an important additional study (RP-1, "The Sequential Evaluation of Sensitivity and Predicative Accuracy of Treadmill Testing Following Myocardial Infarction").

In a very real sense even though this project is considered completed it will continue indefinitely since many of the observations reported on here are made sequentially on all patients followed as part of the cardiac rehabilitation program at the University of Colorado Medical Center.

The main findings of R-157 were reported at the scientific meetings of the American College of Chest Physicians in October, 1976, in Atlanta, Georgia. A paper entitled, "The Clinical Value and Safety of Graded Exercise Testing Soon After Myocardial Infarction" reviewing these data in detail has been prepared and submitted for publication. An abstract of the paper follows:

Abstract

Three hundred forty-six graded exercise tests were performed on 111 patients within 14 weeks after 120 myocardial infarctions. Three groups were reviewed: A (up to 6 weeks post myocardial infarction) undergoing 92 treadmill tests, B (6-9 weeks post infarction with 121 tests; and C (9-14 weeks post infarction) with 133 tests. Blood pressure, percentage corrected maximum heart rate, double product and metabolic equivalents (METS) increased significantly from group A to B to C. No deaths, repeat myocardial infarction or arrhythmias requiring immediate treatment resulted from the treadmill evaluations. The exercise test was very helpful in writing an activity prescription to be followed at home. This allowed 90% of the potentially employable patients to return to work an average of 10.5 weeks after myocardial infarction. It is concluded that graded exercise testing is both safe and of value soon after myocardial infarction.

APPLICABILITY: Utilizing an approach that is readily adapted to the small community hospital environment, the broad applicability of active reconditioning following myocardial infarction has been demonstrated. Careful assessment of the social and vocational aspects of each patient increases the ability of all those individuals caring for the post infarction patients to detect problem areas earlier than we are now able to do. A high percentage of patients can be returned to work at an earlier time following infarction. We anticipate, through incorporation of these data in the Center's training program that more people will be rehabilitated, and that more physicians, particularly at the local level, will become interested in delivering high quality post-infarction rehabilitation services.

226 Clinical Application of Computer Scoring System of Electrocardiograms

Principal Investigator:	William Orr, M.S.	
FY 1976		
Status:	Continuing	
Dates:	December, 1974-December, 1976	
Cost:	Annual $24,140	Projected Total $70,000
	RT Annual $24,140	RT % of Annual Total 100%
Annual Report Reference:	#11, Page 62, R-160	
FY 1977		
Status:	**Completed**	
Dates:	**December, 1974-December, 1976**	
Cost:	**Annual $41,064**	**Projected Total $65,000**
	RT Annual $41,064	**RT % of Annual Total 100%**
Annual Report Reference:	**#12, Page 63, R-160**	

OBJECTIVES: To develop and assess the value of a new computer program to rapidly and efficiently obtain otherwise unavailable data from long tape recordings of single lead ECG's. A further objective is to study the feasibility of developing a control program to permit adjustment of the computer system to accommodate unusual tapes, i.e. those containing arrhythmias not before encountered by the system.

METHODOLOGY: Thirty to 50 ten hour recordings will be selected from patients under care at Colorado General Hospital. One thousand consecutive beats from each of 10 tapes will be scored by a nurse or technician familiar with tape-scanning technique, and the results will be compared with those obtained from a pilot computer program. The pilot program will be derived in part from the program previously developed by the RT Center and in part from other programs developed to detect specific types of arrhythmias. Additional tapes which have been scored in the Cardiac Rehabilitation unit at Colorado General Hospital that contain arrhythmias of particular interest will be stored and evaluated at a later date with the computer system. Differences between computer scoring and technician scoring will be used to update the control program and in effect "educate" the computer. Particular attention will be given to output format in order to present the required information characterizing the tape in the most efficient manner possible for interpretation. In addition, the output data will be presented in a way that is immediately useful and understandable to those responsible for the patient's care.

FINDINGS TO DATE:

The following conclusions have been reached as a result of this project:

1. The QRS spread approach to arrhythmia detection and identification is acceptable for a quiet trace, but is subject to serious error if much artifact is present.
2. The computer analyses developed can detect both supraventricular and vetricular ectopics with detection of atrial premature contractions being the most reliable.
3. The program can be individually modified to look for a specific ectopic waveform.

APPLICABILITY: The major product of this project has been the development and testing of a variable arrhythmia detection program which can greatly facilitate computer ECG analysis. The methods can be applied to optimize patient activity counseling, improve dosage and schedule of anti-arrhythmic medications, and to evaluate certain symptoms when they arise such as palpitations, dizziness, syncope, focal weakness which may be due to underlying arrhythmia.

227 The Assessment of Hypoxia and Reduced Ventilatory Drive in Pulmonary Disability

Principal Investigator:	Giles Filley, M.D.	
FY 1976		
Status:	Continuing	
Dates:	August, 1974-July, 1976	
Cost:	Annual $56,527 RT Annual $29,280	Projected Total $121,000 RT % of Annual Total 52%
Annual Report Reference:	#11, Page 92, R-161	
FY 1977		
Status:	**Completed**	
Dates:	**August, 1974-December, 1976**	
Cost:	**Annual $72,811** **RT Annual $33,425**	**Projected Total $121,000** **RT % of Annual Total 46%**
Annual Report Reference:	**#12, Page 76, R-161**	

OBJECTIVES:

1. To determine in patients with chronic airway obstruction the extent to which hypoxemia and disability are related to depressed ventilatory drive and to elucidate the role of supplemental oxygen in their rehabilitation.
2. To examine the physiological effects of isometric exercise relative to its impact in patients with cardiac and pulmonary disorders.
3. To develop more sensitive techniques for measuring pulmonary diffusing capacity (a measure of the lung's ability to transport oxygen into the blood) for early detection of interstitial lung disease and earlier commencement of therapy. The new techniques might permit the study of patients in greater numbers without sampling the arterial blood (noninvasive techniques).

METHODOLOGY: Diffusing capacity work for the present period had involved measuring the end-tidal carbon monoxide diffusing capacity (DCOET) in normal non-smoking and smoking subjects for various controlled tidal volumes and frequencies. The end-tidal gas sample provides an estimate of the gas composition in the lungs during the respiratory cycle. The subjects breathed carbon monoxide in air mixture for a six minute period at a predetermined tidal volume and frequency. Gases were collected during the final two minutes using a saran-bag end-tidal sampler along with total expired gas collection in a separate rubber bag. A replicability study showed that the overall determination was reproducible to within ±3% for a set of ten determinations made on separate days on one subject. The purpose of these measurements was to observe the effect of depth and frequency of respiration on the measured steady-state carbon monoxide diffusing capacity. We have also initiated work with bolus tracer gas techniques during this period. The tracer techniques are used in conjunction with the steady-state diffusion capacity measurements involves 0.2 mole percent helium as a nonabsorbable tracer in the first inspired tidal volume of the gas collection period. The residence time distribution of a nonabsorbable tracer gas is extremely sensitive to factors affecting the distribution of inspired gases (pathological factors, frequency, tidal volume, body position). The helium concentration in the expirate is continuously monitored using a mass spectrometer. The purpose is to observe the effect of tidal volume and frequency on the residence time distribution of inspired gases so that the dependence of end-tidal DCO on tidal volume and frequency may be explained in terms of changes in residence time distribution and so that gas distribution disturbances caused by obstructive disease processes may be detected. The new test using tracer gas techniques involves the introduction of small strategically placed boluses of helium and carbon monoxide during controlled ventilation on room air. Monitoring of the inspired and expired tracer gas concentration distribution with the mass spectrometer along with flow rate and volume information is being used to observe the distribution of inspired gases (Helium) and diffusion capacity (carbon monoxide). This new testing procedure has great promise for overcoming the inability of existing diffusing capacity tests to detect early disease processes. Detailed descriptions of the techniques and instrumentation used for determining hypoxic and hypercapnic (high CO_2) ventilatory drive have been given in previous progress reports.

FINDINGS TO DATE: Disequilibria in blood while it is in the lungs, and probably acid-base changes across or along pulmonary vessel walls, seem to stimulate chemoreceptors which ensure that lung ventilation is in proportion to total pulmonary blood flow. These findings suggest a unified scheme whereby many diverse and confusing features of the immediate respiro-vascular response to sudden metabolic stress can be explained.

APPLICABILITY: Since both ventilation and circulation participate in gas transport, and must be not only coordinated but adjusted to the demands of exercise, the ability to monitor these events noninvasively has multiple diagnostic and rehabilitative applications in pulmonary rehabilitation.

228 Prognosis in Recovery from Aphasia

Principal Investigator:	Ethel Chang, M.A.	
FY 1976		
Status:	Completed	
Dates:	October, 1974-December, 1975	
Cost:	Annual $8,121 RT Annual $2,921	Projected Total $9,200 RT % of Annual Total 36%
Annual Report Reference:	#11, Page 12, R-507	

OBJECTIVES: Recovery from aphasia is generally assumed to be related to the interaction of several anatomical, physiological and psychological variables including: The patient's age, intelligence, motivation, general health; the type, immediacy, and duration of speech-language treatment; the site and extent of lesion, persistence and severity of hemiparesis, and the type of aphasic syndrome. There is an urgent need for prognostic indicators to direct the selection of efficient, effective management tracks for aphasic adults demonstrating various patterns and severity of speech-language involvement.

METHODOLOGY: All referrals of acute brain-injured adults with aphasia and oral nonverbal apraxia in three cooperating Denver area hospitals were tested by the respective speech pathology services. All subjects received a battery comprised of an oral nonverbal movement task, oral confrontation naming, an auditory processing task daily for one month. Clinicians had been pretrained on scoring these tasks and the intra-clinician reliability was adequate ($r = .93$). All patients were given a spontaneous-imitative speech battery every fifth day, and the Porch Index of Communicative Ability (PICA) every tenth day. Sixteen subjects were obtained during the study period, and no patients received formal speech-language treatment during the project. Age range of the patients was 20 to 80 years with a mean of 52 years. Multiple regression was employed to examine the ability of three performance measures to predict the return of overall communication abilities as measured by the PICA.

FINDINGS TO DATE: A model for predicting overall PICA mean was developed from data collected from days 1 to 7 and days 8-14 of acute hospitalization following stroke. The results suggested that return of overall communication ability can be predicted within two weeks post-onset using weighted mean scores from daily assessment of oral nonverbal movement and confrontation naming. There appears to be the greatest possibility of error in prediction for those patients who obtain low scores initially and increase rapidly, usually errors being in predicting too low the level of language ability eventually attained.

APPLICABILITY: The delineation of prognostic power of oral aprixia, naming, and auditory processing for recovery of language in aphasic stroke patients can lead to more efficient and effective rehabilitation management. Objective data for counseling the patient, family, medical, and paramedical staff about the amount of speech-language improvement to be expected will be made available earlier in the patient's recovery. The early identification of the chronic aphasic adult will facilitate special arrangment for long-term speech-language rehabilitation if indicated.

229 Systems Analysis of the Delivery of Rehabilitation Services in a Rural Setting

Principal Investigator:	Jerome W. Gersten, M.D.	
FY 1976		
Status:	Continuing	
Dates:	July, 1971-September, 1975	
Cost:	Annual $5,874 RT Annual $1,141	Projected Total $50,000 RT % of Annual Total 19%
Annual Report Reference:	#11, Page 89, R-602	
FY 1977		
Status	**Completed**	
Dates:	**July, 1971-July, 1976**	
Cost:	**Annual $8,224** **RT Annual $3,491**	**Projected Total $38,000** **RT % of Annual Total 42%**
Annual Report Reference:	**#12, Page 107, R-602**	

OBJECTIVES: To apply the techniques of systems engineering to a study of the delivery of rural rehabilitative care. In order to meet this objective, the following immediate goals have been established:

1. Develop appropriate mathematical descriptions of the dynamics of rehabilitation care delivery.
2. Acquire necessary data concerning the incidence and prevalence of arthritis, stroke, and chronic lung disease in the specific geographical area of Custer, Chaffee, and Fremont Counties in Colorado.
3. Study possible modifications of the current system which might reduce the size of the untreated population.
4. Design an optimized treatment strategy as a function of patient improvement limits under the constraint of fixed facilities size.
5. Study trade-offs such as the option of having therapists travel to incapacitated patients for treatment in the house or utilizing transportation such as amb-o-cabs to bring patients to a central treatment facility.

METHODOLOGY: The development of the necessary mathematical descriptions was completed in June, 1972.

a. Data collection for the three counties, with regard to arthritis, stroke, and chronic lung disease.
b. During the remainder of the study, attempts will be made to optimize the performance of the rehabilitation care system through simulation of alternative policies. It is hoped that suggestions of alternative modes of treatment, uses of existing facilities, addition to new facilities, etc., will be examined on the computer to study their effectiveness.
c. Completion of this phase has been achieved, unless the need for more data becomes apparent as the analytic program proceeds.
d. Goal under Objectives, represents the major thrust of this project and will require the services of a systems analyst for completion.

FINDINGS TO DATE: During the final stages of this project data collection was completed in three rural counties, and attempts were made to optimize the performance of the rehabilitation care system through simulation of alternative policies. Suggestions of alternative modes of treatment, uses of existing facilities, additions of new facilities, etc., were examined on a computer to study their effectiveness. Four concepts of extending PM & R health services to sparsely populated areas were applied: minicenters, clinic-on-wheels, amb-o-cab, and temporary rest homes.

APPLICABILITY: This investigation has provided input for local and regional health planning through the Office of Comprehensive Health Planning, the Colorado State Health Planning Council, and other planning and service agencies. A complete written report detailing the findings has been submitted to the local office in the participating area engaged in comprehensive health planning.

230 Field Testing of A Cardiac Evaluation Technique for Counselor Use in Vocational Rehabilitation

Principal Investigator:	James W. McDaniel, Ph.D.	
FY 1976		
Status:	Continuing	
Dates:	September, 1975-September, 1977	
Cost:	Annual $1,102 RT Annual $1,102	Projected Total $2,800 RT % of Annual Total 100%
Annual Report Reference:	#11, Page 95, R-806	
FY 1977		
Status:	**Completed**	
Dates:	**September, 1975-September, 1976**	
Cost:	**Annual $2,760** **RT Annual $2,760**	**Projected Total $2,760** **RT % of Annual Total 100%**
Annual Report Reference:	**#12, Page 120, R-806**	

OBJECTIVES: Previous research accomplished at this Research and Training Center has developed a potentially useful and effective tool for counselor use in estimating cardiac work potential. The objectives of the present study are to revise the format of this measure and to present it for field testing by local vocational rehabilitation offices.

METHODOLOGY: The technique involves only a short self-administered inventory, two scales taken from the MMPI, taking approximately twenty minutes for the client to complete. The only additional information needed is the data of functional-therapeutic heart classification (N.Y. Heart Assoc.) which would be available to the counselor through medical examination or earlier medical records. Research information in terms of validity for the prediction of work potential will be obtained from vocational rehabilitation case records. A testing kit composed of test forms, scoring key, and norms will be produced for counselor use in a regional sample of vocational rehabilitation agency offices where cardiac work evaluation is available. Validity of the predicting index will be determined by counselor followup of employment status, which would be done as a matter of course with these clients, and is not an additional requirement of the research.

FINDINGS TO DATE: Results do not appear to warrant further expenditure of effort and funding on this project. Very few state vocational rehabilitation agencies make any special attempts to identify and serve cardiac clients. This probably accounts for the fact that few cardiac cases are to be found among agencies' caseloads.

Test data and follow-up information will continue to be obtained from the participating counselors, but with the expectation that it will take some years before sufficient data is amassed to permit a statistical evaluation of the validity of test predictions of cardiac cases employability.

Valuable information has been obtained as a result of contacts with state vocational rehabilitation agencies during the course of the project. It is rather clear that the agencies, for the most part, devote little time, effort, or resources to case finding/case services for cardiac clients. With few exceptions, cardiac referrals are handled as a minor aspect of the general caseload of vocational rehabilitation counselors. State agencies do not consistently have working relationships with cardiac work evaluation programs, rehabilitation programs, state heart associations, or other resources which are essential for adequate programming. There is an obvious need for improvement in state agencies' role in cardiac rehabilitation.

231 Survey of the Rehabilitation and Employment Problems of Hemodialysis Patients

Principal Investigator:	James W. McDaniel, Ph.D.	
FY 1976		
Status:	Completed	
Dates:	July, 1974-September, 1975	
Cost:	Annual $1,793 RT Annual $1,793	Projected Total $3,410 RT % of Annual Total 100%
Annual Report Reference:	#11, Page 25, R-810	

OBJECTIVES: To determine areas of need for vocational rehabilitation services and the nature of employment problems confronting hemodialysis patients. These data have served as a base of information for workshops conducted at the National Conference of Rehabilitation in End-Stage Renal Disease November 11-13, 1974. These workshops considered current patterns of state vocational rehabilitation agency services to ESRD patients and recommended model agency programs to meet the needs of this population of the severely physically disabled.

METHODOLOGY: In cooperation with the Council of Nephrology Social Workers, the R & T Center coordinated a regionally selected survey of dialysis patients throughout the country. This was a preliminary sampling to determine the extent of rehabilitation and employment problems, and areas of needed service which may be addressed by public vocational rehabilitation programs. Questionnaires were completed by a sample of patients to provide information concerning current employment characteristics, needs for services traditionally supplied by various agencies, and employability in this population. The patient sample was selected by CNSW staff participating in the survey.

FINDINGS TO DATE: A summary of survey results obtained from responses of 171 hemodialysis patients in the Denver, Los Angeles, Seattle, and Chicago areas indicated that only 15% have even had any contact with state vocational rehabilitation agencies. The implication is clear that except in a very few specific locations, no effective vocational rehabilitation program exists for ESRD patients. The preliminary report of these data was given at the National Conference: Vocational Rehabilitation in End-Stage Renal Disease, in 1974. A complete report of findings has been prepared for publication (Technical Report 76-2, December, 1976).

APPLICABILITY: The results of this survey have suggested a critical unmet need for vocational rehabilitation services, a fact totally well recognized in the Rehabilitation Act of 1973. More importantly, it is suggested that a seriously handicapped group exists among dialysis patients who have major obstacles to rehabilitation and independence, and who are not being reached with essential services. If these results are representative of 18,000 dialysis patients throughout the country, then 50% or 9,000 of them are in serious need of services which are not yet available. Given the success rates publicized by rehabilitation agencies, 70-80% or 6,000-7,000 persons should have a reasonable expectation of becoming economically and vocationally self-sufficient if appropriate services were to be made available.

232 Early Adjustment to Steady and Unsteady State Exercise in Patients with Cardiopulmonary Disability

Principal Investigator:	H. L. Brammell, M.D.	
FY 1976		
Status:	New	
Dates:	July, 1976-July, 1977	
Cost:	Annual $46,115 RT Annual $46,115	Projected Total $50,000 RT % of Annual Total 100%
Annual Report Reference:	#11, Page 104, R-9	
FY 1977		
Status:	**Continuing**	
Dates:	**October, 1975-October, 1978**	
Cost:	**Annual $87,615** **RT Annual $87,615**	**Projected Total $200,000** **RT % of Annual Total 100%**
Annual Report Reference:	**#12, Page 135, R-9**	

OBJECTIVES:

1. To evaluate the adjustments to steady and unsteady state exercise, particularly oxygen deficit, in patients with and without cardiopulmonary disorders.
2. To acquire a computer-based physiologic measurement system to monitor ventilation, oxygen consumption, and carbon dioxide production rapidly and on-line.

METHODOLOGY:

1. Construction of a physiologic monitoring system composed of a computerized data acquisition system and mass spectrometer (total gas and flow analysis instrument).
2. Utilizing the monitoring system to evaluate small groups of patients to:
    a. Establish normal oxygen deficit data in subjects without cardiopulmonary disease.
    b. Evaluate the hypothesis that oxygen deficit is greater in patients with functional impairment (New York Heart Association Class II or III) than in normals.
    c. Evaluate the oxygen deficit response in patients with angina pectoris.
    d. Evaluate the early adjustment to exercise in patients with varying degrees of obstructive lung disease.

Analysis of expired air during treadmill exercise, utilizing a bag collection system, carbon dioxide analyzer and fuel cell oxygen analyzer, was done on subjects. The following are some of the observations that were made or computed: minute ventilation, oxygen consumption, CO_2 production, respiratory exchange ratio, METS, anaerobic threshold, percent of maximum oxygen consumption at which anaerobic threshold occurs, heart rate, exercise electrocardiogram repolarization changes and abnormalities in heart rhythm, and blood pressure. Protocols were specific to the groups evaluated.

FINDINGS TO DATE:

a. The construction of a bag collection system for ventilation studies was completed.

b. Using the bag collection system, pre- and post-conditioning studies were done on a group of 15 elderly females between the ages of 63 and 81. Full physiological details are not yet completed, but clear evidence of a conditioning effect has been demonstrated.

c. An on-line computer-based model of the physiologic monitoring system was temporarily pieced together with borrowed items and used to evaluate the functional capacity of 15 professional football players. The data were not particularly surprising; however, the study gave us an opportunity to (1) evaluate a computer program for physiologic monitoring which will be incorporated in the final form system to be developed and (2) evaluate a group of individuals of high functional capacity which permitted vigorous testing of the entire system at high work loads.

APPLICABILITY: Methods which can detect physiologic changes that have the potential of early detection of deterioration, that suggest treatment modification and thereby maintain home, community, and vocational viability have great potential impact on the rehabilitative process. The long-range goal of this project when the monitoring system is completed is to record a series of important physiologic observations longitudinally on patients with cardiopulmonary disorders and to use these physiologic data as indicators of work modification and hopefully as predictors of rehabilitative success or failure.

233 Controlled Evaluation of a Comprehensive Rehabilitation Program Immediately Following Acute Coronary Events

Principal Investigator: **H. L. Brammell, M.D.**
FY 1977
Status: **New**
Dates: **June, 1977-July, 1980**
Cost: **Annual $10,764** **Projected Total $32,000**
RT Annual $10,282 **RT % of Annual Total 96%**
Annual Report Reference: **#12, Page 182, R-10**

OBJECTIVES: This study is designed to evaluate the effects of a comprehensive cardiac rehabilitation program to:

a. Determine the value/no value of rehabilitation after acute coronary events.
b. Determine the feasibility of early return to work.
c. Determine differences (if any) in vocational viability in patients with/without rehabilitation.
d. Determine psychosocial value/no value of cardiac rehabilitation.

METHODOLOGY: Patients will be randomly entered to the study on admission to hospital for management of myocardial infarction – 1 group will be entered in RT-10's comprehensive cardiac rehabilitation program, the control group will not be. Both groups will be longitudinally evaluated with the same parameters. Specific items to be measured include: non-invasive physiological data including treadmill exercise evaluations, psychometric information, educational factors, vocational factors, and new cardiac events.

APPLICABILITY: With increasing numbers of patients becoming candidates for cardiac rehabilitation programs at least one long-term comprehensive care effort needs to be evaluated in a controlled fashion so that this and other programs can be modified to enhance the efficiency of cardiac rehabilitation.

234 Echocardiographic Assessment of Ventricular Motion During Exercise

Principal Investigator: **H. L. Brammell, M.D.**
FY 1977
Status: **New**
Dates: **October, 1976-October, 1977**
Cost: **Annual $1,200** **Projected Total $1,200**
RT Annual $1,200 **RT % of Annual Total 100%**
Annual Report Reference: **#12, Page 175, R-162**

OBJECTIVES: At the present time, echocardiography is helpful in the diagnosis of several types of cardiac disorders. In addition, this non-invasive tool has been used to evaluate certain aspects of left ventricular performance and has substantial value in this area. The use of ultrasound during exercise has not been systematically evaluated, either from an instrumentation or clinical point of view, and this is the principal objective of this project.

METHODOLOGY: Specific methodology for this project will include establishing limits for conventional ultrasound transducers, and the design, fabrication, and testing of new transducers with broader ultrasonic beam patterns. Testing and evaluation of the performance of these methods and systems during exercise with both normal and cardiac patients will be completed.

APPLICABILITY: In recent years the echocardiographic assessment of ventricular function has shown great promise and value, but it is expected that the value of this technique can be greatly enhanced by engineering applications to situations of cardiac stress, e.g., exercise.

235 Hypoxia and Cognitive Functions in Cardiovascular and Obstructive Pulmonary Disease Patients

Principal Investigator:	**James W. McDaniel, Ph.D.**	
FY 1977		
Status:	**New**	
Dates:	**October, 1976-September, 1980**	
Cost:	**Annual $19,062** **RT Annual $19,062**	**Projected Total $80,000** **RT % Annual Total 100%**
Annual Report Reference:	**#12, Page 168, R-807**	

OBJECTIVES: The objectives of this research are to determine the degree of impairment in cognitive, perceptual, and motor efficiency in cardiac and lung diseases; and to determine the relationship to factors responsible for cortical oxygenation.

METHODOLOGY: The project will be carried out using samples of two severely handicapped groups: those having cardiovascular disease, and those with chronic obstructive lung disease. Both experimental groups willbe equated as nearly as possible for age and diastolic blood pressure. Procedures employed will include complex visual discrimination learning situations, and experimental tasks designed to test short-term memory or retention, and visual motor coordination. Performance will be related to physiological parameters of cardiopulmonary function including cardiac output.

APPLICABILITY: Innovative treatment and rehabilitation methods, if they are to be adopted by community health care personnel, should be founded on a complete knowledge of all significant factors which effect rehabilitation outcome. Subtle and ill-defined psychological functions are most often suspected of impeding rehabilitation efforts even with optimal medical management, and this project will attempt to further clarify psychologically disabling effects in cardiac and pulmonary diseases which impair cognitive functions and mental efficiency.

University of Wisconsin-Madison (RT-11)
Waisman Center on Mental Retardation and Human Development

CORE AREAS

Rehabilitation of Families at Risk for Mental Retardation

Comprehensive family rehabilitation which has as its main objective the developmental aspects of retardation with the essential objective of normalizing family units in a variety of community settings that have been, to date, unapproachable utilizing traditional rehabilitation practices. This approach continues to attempt to demonstrate new rehabilitation techniques which will provide a systematic intervention point in ongoing community services delivery systems.

Rehabilitation of the Adolescent and Young Adult Retarded with Severe Behavior Deficits

The rehabilitation process of adolescent and young adult retarded and severely disabled persons with behavioral deficits which can serve as impediments to their effective vocational and/or social adjustment processes. This approach is dealing with the identification of and programming for severely disabled clients referred for evaluation purposes from active rehabilitation facilities programs. The identification of more precise rehabilitation techniques and procedures for this population is the primary objective of this research and clinical services program.

Development of Community Alternatives for Severely Disabled Mentally Retarded Clients

The investigation of community alternatives with severely disabled retarded clients. In the absence of adequate community services for thousands of mentally retarded clients who have been relocated in a variety of community settings, these investigations involving a variety of research techniques are attempting to isolate the needs of these types of clients for habilitation or rehabilitation services. The rehabilitation program, with its current emphasis on the use of community resources in meeting the variety of needs of each rehabilitation client, has the mandated responsibility of providing leadership in developing, implementing and integrating the diverse community services which are necessary to maximize the benefits of deinstitutionalization, both to the client and to society.

UNIVERSITY OF WISCONSIN

Rick F. Heber, Ph.D., Director
University of Wisconsin Mental Retardation
Rehabilitation Research and Training Center
2605 Marsh Lane
Madison, Wisconsin 53706

PROJECT TITLES BY FY 1977 STATUS

COMPLETED

Abstract No.

The Use of a Sentence Repetition Test in Evaluating the Differential Acquisition of Language in Young Disadvantaged Children (Howard Garber, Ph.D.) 236

Grammatical Comprehension Test (Howard Garber, Ph.D.) 237

Grammatical Comprehension of Pre-School Children (Howard Garber, Ph.D.) 238

Free Speech Language Analysis (Howard Garber, Ph.D.) 239

ITPA Testing of Milwaukee Children (Howard Garber, Ph.D.) 240

Berko Morphology (Howard Garber, Ph.D.) 241

Information Transmission in the Mother-Child Dyad (Rick F. Heber, Ph.D.) 242

Standardization of a Technique to Facilitate Indexing Differential Development in Pre-literate Children (Rick F. Heber, Ph.D.) 243

Development of Stimulus Material for Research and Teaching Apparatus (Rick F. Heber, Ph.D.) 244

Oddity Discrimination in Young Children (Rick F. Heber, Ph.D.) 245

Differential Appreciation of Color and Form by Young Children (Howard Garber, Ph.D.) 246

Analysis of Longitudinally Derived Data by a Programmed Statistical Package (Howard Garber, Ph.D.) 247

Bibliography of Language Acquisition and Black Dialect (Howard Garber, Ph.D.) 248

Modified Sentence Repetition Test: II (Howard Garber, Ph.D.) 249

The Use of Sentence Repetition Test II in Evaluating Language Acquisition in Populations with Varying Developmental Histories (Howard Garber, Ph.D.) 250

Word Association Among Low SES Children (Howard Garber, Ph.D.) 251

Effects of Different Types of Frustrating Conditions on the Behavior of Institutionalized Moderately Retarded Adults (William I. Gardner, Ph.D.) 252

Adult BasicEducation for the Mentally Retarded (Karen Reibetanz, M.S.) 253

Client, Family, School and Community Variables Related to the Educational-Rehabilitation Needs of the Mentally Retarded: A Longitudinal Study ('74) (Patrick J. Flanigan, Ph.D.) 254

Home Management Education for the Mentally Retarded (Michael VandenBrook, M.S.) 255

An Investigation of the Mentally Retarded Clients both Rehabilitated and Nonrehabilitated or Rejected by Wisconsin DVR During FY 1974 (Orv. C. Karan, Ph.D.) 256

CONTINUING

Establishment of the High-Risk Population Laboratory (Rick F. Heber, Ph.D.) 257

Crisis Intervention Rehabilitation Applied Research Program for the Severely Developmentally Disabled (Orv Karan, Ph.D. and William I. Gardner, Ph.D.) 258

A Longitudinal Study of the Social, Vocational, Legal and Family Status of Young Adult Mentally Retarded (Rick F. Heber, Ph.D.) 259

DISCONTINUED 1976

Curriculum Material – Development for Creative Thought Processes in the Disadvantaged Child (Howard Garber, Ph.D.)

Differentiating Cognitive Style in Problem Solving (Howard Garber, Ph.D.)

TERMINATED 1976

Development of Self-Management Skills in the Mentally Retarded Adult (Orv Karan, M.A.)

Development of a General Training Program for Increasing the Attending Behavior, Following Simple Directions, Persistence, and Basic Discriminations and Memory Skills of the Severely Detached Adults (William I. Gardner, Ph.D.)

Use of Behavior Therapy Procedures in Treatment of Social and Emotional Difficulties of Retarded Adults (William I. Gardner, Ph.D.)

TERMINATED 1977

The Identification and Improvement of Vocational Rehabilitation Services to Handicapped Clients Who are Homebound (Patrick J. Flanigan, Ph.D.)

236 The Use of a Sentence Repetition Test in Evaluating the Differential Acquisition of Language in Young Disadvantaged Children.

Principal Investigator:	Howard Garber, Ph.D.	
FY 1976		
Status:	Completed	
Dates:	October, 1969-June, 1974	
Cost:	Annual $5,141 RT Annual $3,608	Projected Total $24,420 RT % of Annual Total 70%
Annual Report Reference	#10, Page 23, R-2	

OBJECTIVES: To develop data on rates of language acquisition and dialectal patterns of speech of Milwaukee Project subjects.

METHODOLOGY: A total of 346 tests were given to two groups of children over a two-year period. Testing commenced when each child was 36 months old and was repeated at three-month intervals until the child was 60 months old.

FINDINGS TO DATE: Results indicate superior performance of participants in the preschool stimulation program (E Group) on all measures of evaluation used. They not only produced a significantly greater number of accurate responses (p. .01) than the Control (C) Group at all age levels tested, but also manifested a more rapid and consistent rate of improvement over the two-year testing period. An examination of the imperfect responses made by the two groups indicated that the errors made by the E Group were of a less serious nature (e.g., omission of the definite article, the omission of third person singular marker) than those made by the C Group (e.g., omission of phrases). Furthermore, on two measures used to determine how closely the imperfect morphemes repeated and the percentage of structures preserved – the E Group performed significantly better than the C Group at all age levels, particularly after the first two age levels tested (p .001 for both measures). The measures indicate, perhaps to a greater extent than does the percentage of exact repetitions, the degree to which a child comprehends and controls the linguistic structures in the test. When these two measures were compared with the percentage of exact repetitions, reasonably high correlations were found (r=.822 between % exact repetitions and % morphemes repeated, and r= .813 between % exact repetitions and % structures preserved). This finding suggests that the percentage of accurate responses in a sentence repetition test is a reasonably good predictor of a child's grasp of the syntactic structures in that test.

The complete report on this project, entitled "Developmental Differences in Language as Measured by a Sentence Repetition Test," is included in the Rehabilitation Research and Training Monograph Series which accompanies the 1974 Progress Report.

APPLICABILITY: The data developed from this study will be of use to developmental psycholinguists in their determination of levels of linguistic maturity and of points of structural divergence of English dialects.

237 Grammatical Comprehension Test

Principal Investigator:	Howard Garber, Ph.D.	
FY 1976		
Status:	Continuing	
Dates:	November, 1969-September, 1975	
Cost:	Annual $6,058 RT Annual $4,258	Projected Total $30,290 RT % of Annual Total 70%
Annual Report Reference:	#10, Page 26, R-3	

FY 1977		
Status:	**Completed**	
Dates:	**October, 1969-September, 1975**	
Cost:	**Annual $4,752**	**Projected Total $28,984**
	RT Annual $3,039	**RT % of Annual Total 64%**
Annual Report Reference:	**#11, Page 40, R-3**	

OBJECTIVES:

1. To collect data on the language acquisition and grammatical comprehension abilities of the Milwaukee Project preschool subjects;
2. to show the differential development of the linguistic abilities of these subjects by replicating and expanding Ursula Bellugi-Klima's study of grammatical comprehension.

METHODOLOGY: Bellugi-Klima Grammatical Comprehension tests are given to subjects at 36 months of age and every third month thereafter until 6 years of age.

FINDINGS TO DATE:

1. Complete data has been collected from the age of 36 months to that of 69 months. Data for the age of 72 months has been impossible to collect.
2. There continues to be a differential development of language ability between the control group and the experimental group with the latter remaining superior to the former.
3. Three measures have been used to analyze the test results: items correct, subtests correct, and individual subtests acquired. In each of these measures the experimental group surpassed the control group.
4. While both groups had difficulty with certain contrasted features, the comprehension of the experimental group covered a wider range of syntactic categories than that of the control group.

APPLICABILITY: There is little published research on the grammatical comprehension ability of young children. The Bellugi-Klima test will add to the body of knowledge concerned with the language acquisition ability of children, and thereby, be useful in the design of curriculum materials and the evaluation of preschool language programs. A comparison of experimental and control groups will aid in the evaluating the enrichment program of the Milwaukee Project.

238 Grammatical Comprehension of Pre-School Children

Principal Investigator:	Howard Garber, Ph.D.	
FY 1976		
Status:	Continuing	
Dates:	October, 1969-December, 1975	
Cost:	Annual $1,593	Projected Total $12,534
	RT Annual $1,593	RT % of Annual Total 100%
Annual Report Reference:	#10, Page 29, R-4	
FY 1977		
Status:	**Completed**	
Dates:	**October, 1969-December, 1975**	
Cost:	**Annual $2,854**	**Projected Total $13,299**
	RT Annual $1,739	**RT % of Annual Total 61%**
Annual Report Reference:	**#11, Page 44, R-4**	

OBJECTIVES:

1. To develop the Bellugi-Klima Grammatical Comprehension Test on a preschool population of differing social and economic status;
2. to provide reference data on the language acquisition and grammatic comprehension of middle and low SES children for general use and for comparison to the same data from the Milwaukee Project children.

METHODOLOGY: Bellugi-Klima Grammatical Comprehension tests were administered to 18 white children at 66 months of age from a semi-rural fourth class city of unascertainable SES and to Milwaukee Project children of the same age.

FINDINGS TO DATE:

1. The Milwaukee Project experimental children scored higher than the comparison population on the percentage of items and subtests correct.
2. The Milwaukee Project controls scored lower than both the experimental and comparison groups in both categories.
3. In general, both the comparison and the experimental groups performed comparably with the latter performing notably higher on four subtests: possessives, adjectival modifiers, reflexive and reciprocal pronouns, and single comparatives.

APPLICABILITY: There is a lack of published data in the area of language acquisition. The results of this project should help in establishing norms or developmental referrents in order to evaluate the grammatical comprehension of children, particularly those who are high-risk non-standard dialect speaking.

239 Free Speech Language Analysis

Principal Investigator:	Howard Garber, Ph.D.	
FY 1976		
Status:	Continuing	
Dates:	October, 1968-November, 1975	
Cost:	Annual $7,188 RT Annual $5,173	Projected Total $43,128 RT % of Annual Total 72%
Annual Report Reference:	#10, Page 32, R-5	
FY 1977		
Status:	**Completed**	
Dates:	**October, 1968-September, 1975**	
Cost:	**Annual $3,603** **RT Annual $2,256**	**Projected Total $39,543** **RT % of Annual Total 63%**
Annual Report Reference:	**#11, Page 47, R-5**	

OBJECTIVES:

1. To determine the effects of language and sensory stimulation on low SES children by means of a free speech measure;
2. to identify developmental trends in language acquisition;
3. to make a longitudinal analysis of data from children's free speech.

METHODOLOGY: Free speech samples were recorded every three months from 18 months of age to 66 months of age. Cross-sectional sampling of the data was made and submitted to Lee and Canter's (1971) Developmental Sentence Scoring in order to measure differential syntactic development at the 60-63 month age level in both experimental and control children from the Milwaukee Project.

FINDINGS TO DATE: Gross feature tabulation of free speech, while demonstrating the superior language development of the experimental group, did not consistently maintain its sensitivity or provide information on syntactic development. Lee and Canter's Development Sentence Scoring was adopted to provide a more sophisticated analysis of children's spontaneous speech. A compensatory scoring procedure was adapted in order to measure the presence of nonstandard dialect in the children's speech. However, neither scoring procedure has proven to be as sensitive or comprehensive as desired.

APPLICABILITY: The findings of this project will provide guidelines for the development of language programs for both culturally disadvantaged and linguistically deprived children. Comparison of experimental and control groups will aid in evaluating the enrichment program of the Milwaukee Project.

240 ITPA Testing of Milwaukee Children

Principal Investigator:	Howard Garber, Ph.D.	
FY 1976		
Status:	Completed	
Dates:	October, 1971-December, 1974	
Cost:	Annual $5,161 RT Annual $3,697	Projected Total $15,483 RT % of Annual Total 72%
Annual Report Reference:	#10, Page 35, R-6	

OBJECTIVES:

1. To utilize the Illinois Test of Psycholinguistic Ability, a standard measuring device, to develop data on the language acquisition rates and psycholinguistic abilities of the Milwaukee Project children;
2. to compare the results with findings in the published research.

METHODOLOGY: The first test was given to each of the Milwaukee Project children at 54 months of age. The second test was given to the children at 78 months of age. Comparisons were made between the experimental and control groups and between the two testings.

FINDINGS TO DATE: A retest at 78 months of the children originally tested at 54 months indicates that the wide differential in psycholinguistic quotient points (29.3 at 54 months and 20.5 at 78 months) has been maintained.

APPLICABILITY: This project hopes to facilitate the understanding of language development in the Milwaukee Project children through the use of ITPA. It is further hoped that, because of the diagnostic implications of the test, the results of this project will provide opportunities for the remediation wherever problem areas are found.

241 Berko Morphology

Principal Investigator:	Howard Garber, Ph.D.	
FY 1976		
Status:	Completed	
Dates:	October, 1970-December, 1974	
Cost:	Annual $5,539 RT Annual $4,667	Projected Total $22,156 RT % of Annual Total 84%
Annual Report Reference:	#10, Page 37, R-8	

OBJECTIVES:

1. To develop data on rates of language acquisition and dialectal patterns of speech in Milwaukee Project subjects;
2. to measure the differential language development of the participants and nonparticipants in the preschool stimulation program of the Family Rehabilitation Project using the methods suggested by Jean Berko.

METHODOLOGY: Berko Morphology tests were given to subjects at 95 months of age and every third month thereafter. Scoring was done by a trained linguist.

FINDINGS TO DATE:

1. The results indicate a superior overall performance by those participating in the preschool stimulation program.
2. Test results from the 60 to 78 month age period indicate that the experimental group has maintained a significant advantage over the control group in the acquisition of standard English morphology.

3. On the Picture Morphology test, which uses real words, both groups exhibited a gradual acquisition of inflectional morphology, but the experimental group was clearly superior to the control group at all age levels.
4. Neither group performed as well on the Berko Morphology as on the Picture Morphology. This is in part due to the fact that Berko's use of nonsense syllables eliminates the possibility that a child may have memorized inflected forms of particular lexical items. Over the eighteen month testing period, the experimentals made gradual improvement on the Berko test, but the controls seemed to gain little facility in inflecting nonsense syllables.

APPLICABILITY: The results of this study will help determine the nature of the preschool training and language assessment that can help increase the language development rate of disadvantaged children.

242 Information Transmission in the Mother-Child Dyad

Principal Investigator:	Rick F. Heber, Ph.D.	
FY 1976		
Status:	Completed	
Dates:	October, 1971-June, 1974	
Cost:	Annual $2,029	Projected Total $5,580
	RT Annual $1,741	RT % of Annual Total 86%
Annual Report Reference:	#10, Page 40, R-10	

OBJECTIVE: To provide further information concerning the development aspects of mother-child interaction within a disadvantage population.

METHODOLOGY:

1. The data was divided into three sections: the analysis of informational associations; the quantification of verbal and physical behaviors in the categories of information processing, positive feedback, and negative feedback; and task success.
2. Through the use of a videotaped structured teaching situation with a mother and her child in an experimental room, ratings were made and that data analyzed using information theory and categorized contingency responses.

FINDINGS TO DATE:

1. The study's main finding was that the verbal level of the experimental children carried the performance of the experimental dyads. There was evidence of diffusion from the child to the mother. These findings were supported upon replication and the infusion process seemed to have been enhanced over time.
2. A new technique for the analysis of mother-child communications permitted additional insights and conclusions. The formation of a reciprocal feedback loop was supported by the presence of responsive behaviors by the experimental mothers and by their extensive uses of positive feedback (i.e. praise and approval). No additional mother-child dyad observations were made this year due to difficulties in scheduling children in school.

APPLICABILITY: The major significance of this study of mother-child communication is the quantification of

243 Standardization of a Technique to Facilitate Indexing Differential Development in Pre-literate Children

Principal Investigator:	Rick F. Heber, Ph.D.	
FY 1976		
Status:	Completed	
Dates:	February, 1970-September, 1974	
Cost:	Annual $3,694	Projected Total $12,929
	RT Annual $2,861	RT % of Annual Total 77%
Annual Report Reference:	#10, Page 43, R-11	

OBJECTIVE: To develop standardized techniques for assessing differential language development in order to reveal slower intellectual development at an earlier age than presently possible.

METHODOLOGY: The Ivanov-Smolensky procedure was used. The procedure requires the subject to give a bulb squeezing response in reaction to a series of coordinated verbal commands.

FINDINGS TO DATE: The Ivanov-Smolensky procedure has been modified in order to facilitate the transfer from the pretraining task and in order to enhance discrimination in the subsequent phases. Due to equipment modification, little progress was made in expanding the research to new populations. At the present time, an exploration is being made into the usefulness of this procedure with a group of institutionalized hyperactive children.

APPLICABILITY: This technique may prove to be a sensitive early warning device capable of revealing slowed intellectual development at an age when ameliorative intervention programs will be most beneficial.

244 Development of Stimulus Material for Research and Teaching Apparatus

Principal Investigator:	Rick F. Heber, Ph.D.	
FY 1976		
Status:	Continuing	
Dates:	October, 1973-December, 1975	
Cost:	Annual $1,763 RT Annual $1,449	Projected Total $3,526 RT % of Annual Total 82%
Annual Report Reference:	#10, Page 45, R-12	
FY 1977		
Status:	**Completed**	
Dates:	**October, 1973-December, 1975**	
Cost:	**Annual $5,058** **RT Annual $2,392**	**Projected Total $6,821** **RT % of Annual Total 47%**
Annual Report Reference:	**#11, Page 50, R-12**	

OBJECTIVES: To develop a library of stimulus materials appropriate for both teaching and research.

METHODOLOGY: Stimulus cards containing three sets of felt cutouts, with the odd member being differentiated on the basis of color, form, size or number. Subjects were tested individually and asked to choose one that was different.

FINDINGS TO DATE: The stimulus material is used in our laboratory with research in the Milwaukee Project. In addition, population samples for comparison purposes to the Milwaukee Project and for general data accumulation are being tested with this material. These programs are readily available with research data from our stimulus library as experimental learning paradigms.

APPLICABILITY: Findings indicate ages at which these concepts can effectively be introduced into curriculum for low SES children.

Reduces inconsistency between laboratory replications of early learning research.

245 Oddity Discrimination in Young Children

Principal Investigator:	Rick F. Heber, Ph.D.	
FY 1976		
Status:	Continuing	
Dates:	July, 1970-September, 1975	
Cost:	Annual $1,788 RT Annual $1,579	Projected Total $7,152 RT % of Annual Total 88%
Annual Report Reference:	#10, Page 47, R-14	

FY 1977
Status: **Completed**
Dates: **July, 1970-September, 1975**
Cost: **Annual $1,669** **Projected Total $7,033**
RT Annual $575 **RT % of Annual Total 34%**
Annual Report Reference: **#11, Page 52, R-14**

OBJECTIVES:

1. To assess the development of the concepts of "same" and "different" in low socio-economic status children as a function of age and intelligence;
2. to develop a standardized methodology, sensitive to differential development, for examining the characteristics of learning performance in young children.

METHODOLOGY: Stimulus cards were made containing three sets of felt cut-outs with the odd member being differentiated on the basis of color, form, size, or number. Subjects were tested individually and asked to choose the odd member.

FINDINGS TO DATE: The study has been replicated six times with an improvement in the testing materials each time. An analysis of the data collected indicates that the experimental group (preschool training participants in the Milwaukee Project) continues to have a performance superior to that of the Control group. A predominant characteristic of the low IQ group is perseveration in terms of response and a general apathy in terms of participation. The experiment group's continued superior performance was especially noted in the form and color dimensions. There has been some reduction in the tendency for both groups to have stereotyped responses.

APPLICABILITY: The findings of this study will indicate the ages at which the concepts of "same" and "different" can effectively be introduced into the curriculum for low socio-economic status children. A comparison of the control and experimental group will aid in evaluating the enrichment program of the Milwaukee Project.

246 Differential Appreciation of Color and Form by Young Children

Principal Investigator: Howard Garber, Ph.D.
FY 1976
Status: Continuing
Dates: November, 1969-September, 1975
Cost: Annual $1,213 Projected Total $6,065
RT Annual $1,004 RT % of Annual Total 83%
Annual Report Reference: #10, Page 49, R-15
FY 1977
Status: **Completed**
Dates: **November, 1969-September, 1975**
Cost: **Annual $1,713** **Projected Total $6,565**
RT Annual $288 **RT % of Annual Total 17%**
Annual Report Reference: **#11, Page 54, R-15**

OBJECTIVE: To develop specific learning performance profiles of young children enabling them to be controlled in other learning procedures and to use these profiles in facilitating learning in other situations.

METHODOLOGY: Simple geometric colored forms are presented to the various subjects who are then required to indicate matching strategies.

FINDINGS TO DATE:

1. Preliminary findings indicated a general insensitivity by low IQ subjects to their own response. Most of the low IQ subjects responded only to position irrespective of the stimulus value of reinforcement contingencies. This behavior seemed to increase with age.
2. The most recent data indicate an improvement by both the experiment and control groups in the performance as regards their tendency to select undimensional items. The control group's performance still lags behind the experimental group's performance. The response behavior of the latter group is still more sophisticated than that of the former group.

APPLICABILITY: Since early learning through the attentional process seems to vary as a function of developmental history, it may be possible through early training programs, such as the Milwaukee Project to bring about the earlier development of stimulus organization behavior.

247 Analysis of Longitudinally Derived Data by a Programmed Statistical Package

Principal Investigator:	Howard Garber, Ph.D.	
FY 1976		
Status:	Continuing	
Dates:	September, 1971-December, 1975	
Cost:	Annual $2,923 RT Annual $2,154	Projected Total $12,666 RT % of Annual Total 74%
Annual Report Reference:	#10, Page 51, R-16	
FY 1977		
Status:	**Completed**	
Dates:	**September, 1971-December, 1975**	
Cost:	**Annual $5,056** **RT Annual $3,220**	**Projected Total $14,799** **RT % of Annual Total 64%**
Annual Report Reference:	**#11, Page 57, R-16**	

OBJECTIVES:

1. To develop the potential of the programmable calculator to work with data from longitudinal studies;
2. to use the calculator for providing the researcher with immediate, on-going feedback and to carefully analyze individual aspects of this process;
3. to explore and develop the possibilities for a major computer analysis to supply multidimensional evaluation of long-term effects.

METHODOLOGY: Through the development of new programs for data analysis and the evaluation of statistical tests, it is hoped that the interpretation of longitudinal data will be maximized.

FINDINGS TO DATE:

1. The ability to analyze data has increased significantly with the coding of data on to punch cards for analysis by the computer and by existing statistical packages.
2. The results of this project helped to determine with greater accuracy the span of usefulness of Milwaukee Project tests. In addition, the results helped to provide standardized criteria with which test data could be analyzed and which were able to pinpoint test sensitivity.
3. In cases of test revision, the project's results helped to provide new criteria for the analysis of results. It was also determined that should a test be revised, it would be wise to include a back-to-back testing of the two tests.

APPLICABILITY: The formalization of a set of calculator programs can put powerful and convenient statistical tools in the hands of many researchers. In addition, by demonstrating the power of the electronic calculator as a mathematical aid, the results of this project will encourage research that was considered impractical because of the expense of computer operation.

248 Bibliography of Language Acquisition and Black Dialect

Principal Investigator:	Howard Garber, Ph.D.	
FY 1976		
Status:	Completed	
Dates:	August, 1971-December, 1974	
Cost:	Annual $3,620 RT Annual $2,811	Projected Total $12,066 RT % of Annual Total 78%
Annual Report Reference:	#10, Page 54, R-19	

OBJECTIVE: To develop an understanding of Black dialect and related aspects of language acquisition.

METHODOLOGY: A thorough search was made of all relevant books and articles in order to compile the bibliography.

FINDINGS TO DATE: An annotated bibliography on social and psycholinguistic studies of Black English has been updated to include publications through 1975. A brief introduction outlines current trends in scholarship.

APPLICABILITY: This bibliography will enable preschool teachers and researchers to be further acquainted with the problems involved with language acquisition and Black Dialect.

249 Modified Sentence Repetition Test: II

Principal Investigator:	Howard Garber, Ph.D.	
FY 1976		
Status:	Continuing	
Dates:	October, 1971-September, 1975	
Cost:	Annual $5,828 RT Annual $4,196	Projected Total $23,312 RT % of Annual Total 74%
Annual Report Reference:	#10, Page 56, R-20	
FY 1977		
Status:	**Completed**	
Dates:	**October, 1971-September, 1975**	
Cost:	**Annual $11,219** **RT Annual $7,447**	**Projected Total $28,703** **RT % of Annual Total 66%**
Annual Report Reference:	**#11, Page 60, R-20**	

OBJECTIVES: To determine, for children participating in the Family Rehabilitation Project, variations in performance levels during the recall of sentences varying in degree of difficulty.

METHODOLOGY: The subjects are being tested at 60 months and every third month thereafter. Scoring is being done by trained linguists.

FINDINGS TO DATE:

1. The findings to date indicate a continued superior performance by the experimental group, who gave consistently more correct responses in the various categories of sentence length and syntactic complexity, in comparison to the control group.
2. Sentence length has a marked effect on the performance of each group. However, the experimental group is particularly responsive to changes in sentence length.
3. Sentences with embedded clauses proved to be the most difficult for both groups to accurately repeat. Compound structures were the next most difficult.
4. There is little variation in performance for both groups when kernel sentences and their transformations are repeated, thus disproving the hypothesis that the kernel sentence is easier to recall than any of its transformations.
5. An analysis is being made of the errors made by the children in repeating the stimulus sentences.

APPLICABILITY: This study will help in determining pre-school training methods and language tests that will best help to increase the language development rate of disadvantaged children.

250 The Use of Sentence Repetition Test II in Evaluating Language Acquisition in Populations with Varying Developmental Histories

Principal Investigator:	Howard Garber, Ph.D.	
FY 1976		
Status:	Completed	
Dates:	October, 1971-October, 1974	
Cost:	Annual $3,720 RT Annual $2,916	Projected Total $11,160 RT % of Annual Total 78%
Annual Report Reference:	#10, Page 60, R-21	

OBJECTIVES:

1. To compare the results of the Sentence Repetition Test administered to children participating in the Family Rehabilitation Project with results previously obtained from white lower and middle class children;
2. to determine the differential levels of language development in children from different populations.

METHODOLOGY: Tests were administered at 60 months and every third month thereafter. Scoring was done by trained linguists.

FINDINGS TO DATE:

1. Data on white children from the 60 months to the 69 months level has been compiled. Difficulties have been encountered in ascertaining the socio-economic background of the white children tested, thus no SES classification could be made for them. Another area of difficulty has been the unavailability of the white children for re-testing at three month intervals; therefore, the groups represented by age levels comprise different children, in comparison to the longitudinal experimental and control samples.
2. The performance by the sample of white children, in terms of exact repetitions, is generally superior to both the black experimental and control groups, with the exception of the 69 month level.
3. The inconsistency in the white group's performance, especially in comparison to the trends shown by the experimental and control groups, emphasizes the methodological difficulty in comparing certain types of data derived from longitudinal and cross-sectional sampling.
4. Further analysis, including SES level, educational level of the parents, the types of errors found, and features affected by dialect, is being undertaken.

APPLICABILITY: The results of this test will help to determine those preschool training methods and language tests which will best help to increase the rate of language development in disadvantaged children.

251 Word Association Among Low SES Children

Principal Investigator:	Howard Garber, Ph.D.	
FY 1976		
Status:	Completed	
Dates:	December, 1971-September, 1974	
Cost:	Annual $3,761 RT Annual $2,755	Projected Total $11,283 RT % of Annual Total 73%
Annual Report Reference:	#10, Page 64, R-23	

OBJECTIVES:

1. To evaluate the types of word associations given by low SES children as a function of age and participation in the stimulation portion of the Milwaukee Project;
2. to determine the age at which word association shift occurs as a consequence of the development of semantic and paradigmatic memory.

METHODOLOGY: This study utilized a list of words previously used with low SES children (Entwisle, 1970) which forced them to respond with the first word given them. A trained experimenter familiar with all the children administered the test.

FINDINGS TO DATE: All the subjects have been tested and their responses analyzed by the language laboratory staff. The results revealed no significant differences between the responses of the experimental and control children. The technique of word association proved to be of less value than expected. It appears that the difficulties lie in obtaining explanatory sentences from young children to clarify ambiguous responses and in the children's understanding of the meaning of word association.

APPLICABILITY: This study will provide information concerning the use of specific rehabilitation curriculum upon the development of higher level semantic associations.

252 Effects of Different Types of Frustrating Conditions on the Behavior of Institutionalized Moderately Retarded Adults

Principal Investigator:	William I. Gardner, Ph.D.	
FY 1976		
Status:	Completed	
Dates:	October, 1973-September, 1974	
Cost:	Annual $7,121	Projected Total $7,121
	RT Annual $5,354	RT % of Annual Total 75%
Annual Report Reference:	#10, Page 77, R-31	

OBJECTIVES:

1. To assess the behavior of the mentally retarded adult during his reaction to different types of frustrating conditions employing delay of reward, thwarting of ongoing behavior and conflict operations;
2. to investigate a procedure for increasing the frustration tolerance of the mentally retarded;
3. to evaluate the amount of transfer from one type of frustrating condition to another.

METHODOLOGY:

1. Eight moderately retarded adults exhibiting patterns of low frustration tolerance to work-related situations were the subjects.
2. The subjects were taught through graduated modeling to perform a work task. This consisted of placing various colored marbles in receptacles to match specific patterns indicated by a lighted stimulus located in front of each subject.
3. Subjects worked independently and received monetary reinforcement for correct task performance until a steady state of responding was achieved.
4. Subjects received a five-session frustration period, during which one of three different types of frustrating conditions were given on every fifth response sequence while reinforcement was continued.
5. The subjects then saw three video-taped modeling sessions depicting a demonstration of appropriate behavior under the same frustrating conditions they underwent.
6. The work and frustration period were then repeated.

FINDINGS TO DATE: Results suggest that great variations exist in the manner in which individuals perform under frustrating conditions and the extent to which different individuals are able to tolerate it.

However, the more important findings are the differences in performance of subjects before and after exposure to a social model demonstrating appropriate behavior as well as differences in the performance of subjects exposed to a model and those not exposed to a model. Essentially these findings indicate that one method of dealing with low frustration tolerance is through the use of modeling, a technique which can be used in a variety of situations.

APPLICABILITY: Rehabilitation personnel working with the mentally retarded who display low frustration tolerance have some data basis for a rehabilitation procedure. The modeling procedure, combined with others in a rehabilitation program, offers promise of increasing the vocational competence of the mentally retarded clinet.

253 Adult Basic Education for the Mentally Retarded

Principal Investigator: Karen Reibetanz, M.S.
FY 1976
Status: Completed
Dates: February, 1974-December, 1974
Cost: Annual $4,228 Projected Total $4,228
RT Annual $3,220 RT % of Annual Total 76%
Annual Report Reference: #10, Page 88, R-33

OBJECTIVE: To demonstrate that adult mentally retarded individuals can significantly improve in reading and arithmetic through the implementation of an educational program structured to meet their needs.

METHODOLOGY:

1. Sixty-five subjects, thirty-five male and thirty female, with IQs ranging from eighty-three to eighty-eight comprise the experimental and control groups.
2. The AAMD Adaptive Behavior Scales were given as a screening device to the entire sample population. Individuals that received a low score in the reading and arithmetic areas comprised the subject pool. After this, the Peabody Individual Achievement Test (PIAT) was given as a pretest of the baseline functioning of both the experimental and control groups.
3. After testing, the subjects were divided into small groups which received treatment or nontreatment for one-half hour three times per week. Token reinforcement occurred at the end of each class period and was contingent upon the specific behavioral objectives planned for each individual or small group.
4. Following the completion of the testing, the treatment was carried on for sixteen weeks. Immediately upon termination of the treatment, all subjects and controls were tested on the PIAT.

FINDINGS TO DATE: Results show that the mentally retarded have potential for learning, they can benefit from basic education and indicates that the total need of the mentally retarded should be considered when providing rehabilitation services.

Not only do mentally retarded persons have potential for learning vocational tasks but they have the capacity to understand math concepts as well as reading skills.

APPLICABILITY: The results of this research project should be taken into consideration and applied when planning rehabilitation programs for mentally retarded persons. A specific educational curriculum designed to meet the individual needs of the mentally retarded person should be provided in a rehabilitative service program.

254 Client, Family, School and Community Variables Related to the Educational-Rehabilitation Needs of the Mentally Retarded: A Longitudinal Study (74)

Principal Investigator:	Patrick J. Flanigan, Ph.D.	
FY 1976		
Status:	Continuing	
Dates:	April, 1972-June, 1976	
Cost:	Annual $23,130 RT Annual $17,250	Projected Total $92,520 RT % of Annual Total 75%
Annual Report Reference:	#10, Page 93, R-34	
FY 1977		
Status:	**Completed**	
Dates:	**April, 1972-June, 1976**	
Cost:	**Annual $30,456** **RT Annual $19,577**	**Projected Total $99,846** **RT % of Annual Total 64%**
Annual Report Reference:	**#11, Page 64, R-34**	

OBJECTIVES: "Client, Family School and Community Variables Related to the Educational-Rehabilitation Needs of the Mentally Retarded" is a Longitudinal Study focusing upon identification of the variables which impede or facilitate the vocational rehabilitation of the young mentally retarded adults, and upon determining if adequate rehabilitation services are being provided.

METHODOLOGY:

1. Thirty-three variables from four general classes (client, community, familial, and educational characteristics) were identified from a literature survey and a questionnaire. The possible relationship to outcome criteria will be analyzed for each group. A self-constructed "dimension of life style of the retarded" rating scale is being used. The variables were categorized according to a nominal scale.
2. Current employment status is being used as a measure of rehabilitation status.
3. The subjects consist of 81 young adults between the ages of 16 and 20 who on September 1,1965 were enrolled in Wisconsin special education classes for the 1965-66 school year and either had or had not received VR services.

FINDINGS TO DATE:

1. The findings of the first phase of the project indicate possible relationships between the vocational adjustment of clients who had received VR services and the following potential predictor variables: SSDI or trust fund status at time of referral, age of referral, referral source, secondary disability, previous closures(s), previous referral outcomes, and work status at acceptance for VR services.
2. The results of this project also indicate the need for an intensive analysis of potential predictor variables since professionals disagree regarding what variables are to be associated with what vocational outcome.
3. The second phase of the project anticipates the formal evaluation of their relationships through their classification as predictor variables. This will involve the evaluation of selected subjects, their family, education and community characteristics.

APPLICABILITY: Pertinent findings will be disseminated through monographs, professional journals and to participants in training institutes. Results will also be distributed in the form of working papers to vocational rehabilitation personnel.

Information acquired during the project should be of aid to various social service agencies in their future programming for specific groups. The findings may be utilized by rehabilitation agencies to identify and expand existing programming needs of the mentally retarded.

Final analysis of the data may warrant changes in the service delivery system of Vocational Rehabilitation Services as related to mentally retarded adults. Data derived from this project may indicate that vocational rehabilitation personnel should alter their present operating procedure when assisting the retarded in the areas of vocational planning and daily living.

255 Home Management Education for the Mentally Retarded

FY 1976 Status:	Proposed	
Principal Investigator:	**Michael VandenBrook, M.S.**	
FY 1977		
Status:	**Completed**	
Dates:	**February, 1975-December, 1975**	
Cost:	**Annual $13,742**	**Projected Total $13,742**
	RT Annual $9,438	**RT % of Annual Total 69%**
Annual Report Reference:	**#11, Page 77, R-38**	

OBJECTIVES: To demonstrate that adult mentally retarded individuals can significantly improve certain life situation skills through the implementation of a curriculum designed specifically for this.

METHODOLOGY:

1. Sixty subjects comprised the sample population which included 28 males and 32 females. IQ's ranged from 32-85. Thirty subjects were assigned to experimental group and thirty to the control group.
2. Two evaluative instruments were used to measure the effect of the experimental condition. One was an objective test, constructed by the author and a teacher at Madison Opportunity Center, based on the Home Management Curriculum. Secondly the behavioral objectives that accompanied the Home Management Curriculum were utilized. Both measures were administered to all subjects and controls.
3. After pretesting, the experimental subjects were assigned to small groups, (4-5), that received the treatment for forty-five minutes, three times per week for sixteen weeks. Social reinforcement was used when clients met the instructional goals.
4. At the end of the sixteen week instructional periods, each subject was post-tested to determine the effects of treatment.

FINDINGS TO DATE: Results show that there are positive implications for the basic education of the adult retarded person. Over a relatively short treatment period, the experimental group demonstrated highly significant gains in home management skills. This fact lends support to the statement that the adult retarded person is capable of achieving significant gains in independent functioning skills when educational interventions are structured to meet their needs.

APPLICABILITY: The positive results should serve to encourage both clients and staff with regard to the efficacy of educational programming and should provide a forward impetus to the delivery of educational services in rehabilitative programs. Additionally, the results serve to demonstrate that special post school programming can serve to assist the mentally retarded individual in realizing his maximum potential to function as normally as possible.

256 An Investigation of the Mentally Retarded Clients both Rehabilitated and Nonrehabilitated or Rejected by Wisconsin DVR During FY 1974

FY 1976 Status:	Proposed	
Principal Investigator:	**Orv C. Karan, Ph.D.**	
FY 1977		
Status:	**Completed**	
Dates:	**April, 1975-January, 1976**	
Cost:	**Annual $14,922**	**Projected Total $14,922**
	RT Annual $8,642	**RT % of Annual Total 58%**
Annual Report Reference:	**#11, Page 83, R-39**	

OBJECTIVES: The primary objective of this study was to identify those client characteristics reported on the DVR case service reports (R-300) most frequently associated with both positive (status 26) and negative (status 08, 28, and 30) closure.

In its present form, the R-300 form includes only rather broad categories which counselors then select as their reasons for closing clients. Some of these categories are relatively clear, however among at least seven categories there is much ambiguity. For example, "failure to cooperate" is extremely broad and really of very little value to rehabilitation planners concerned with improving services. Thus, a secondary objective of this study was to identify more closely the DVR counselors' interpretation of the reasons for negative closures.

METHODOLOGY: Fiscal year 1974 data available from the DVR case service reports and specific to only the mentally retarded seen by Wisconsin DVR was obtained and analyzed using the four closure codes (08, 26, 28 and 30) as the primary information categories. On the basis of the information generated from this data, a survey instrument was developed and distributed to all DVR counselors (except those serving the blind) in the State, for the purpose of obtaining a clear picture of those client behaviors, as defined by the counselor, which were most likely to lead to negative closure.

FINDINGS TO DATE: On the basis of the data generated from the R-300 forms, a total of 2,305 mentally retarded clients were closed in one of the four closure categories in fiscal year 1974. Of this number, 34.3% were closed status 08, 56.4% were closed status 26, 7.4% were closed status 28, and 1.9% were closed in status 30. Thus, while over half of the mentally retarded clients served by vocational rehabilitation during fiscal year 1974 were successfully rehabilitated, 43.6% were either declared ineligible for services, or were terminated from services prematurely.

As a means of assessing general parameters in relation to successful vs. unsuccessful rehabilitation, six different demographic variables were analyzed in this study. They were: sex, race, age, severity of disability, Spanish surname, and work-study program affiliation.

In general, the results of the analysis of the data suggest that persons who are more often not rehabilitated were those labeled as severely retarded, non-white, those not participating in work-study programs and those beyond high school age. White, mildly and moderately retarded persons, those participating in work study programs, and those of high-school age were most likely to be successfully rehabilitated. There were no significant differences according to sex in the distribution of closure categories.

In an attempt to ascertain more precisely the actual reasons why clients were either rejected or non-rehabilitated, survey instruments were designed and sent to all DVR counselors in the State of Wisconsin except those who had primary responsibilities for serving the blind. The purpose of these surveys was to attempt to reach a better understanding of the three reasons most frequently given for either rejecting or closing as non-rehabilitated these specific clients, namely: (1) handicap too severe or unfavorable medical prognosis, (2) refusal of service, or (3) failure to cooperate. A total of 193 counselors were sent the surveys, and 62% returned them.

The general picture which evolves from the analysis of the survey instruments suggests that if a client has the basic prerequisite skills to fit into the vocational rehabilitation system and does not refuse services once they are offered, he or she is likely to make it within the vocational rehabilitation process. On the other hand, clients lacking the basic skills, or assumed to be lacking these skills on the basis of a low intelligence quotient, are very likely to be rejected from vocational rehabilitation services. In general then, mentally retarded clients who fit the system by the nature of their entering behaviors are more likely to go through the entire process than those who don't fit the system. And, the results of the survey suggest that the rehabilitation process does not seem to be ready to fit the needs of the client rather it is expected that the client will fit the needs of the process.

APPLICABILITY: It is anticipated that the results of this investigation will assist rehabilitation planners in preparing to meet the needs of heretofore unrehabilitatable mentally retarded clients. Rehabilitation efforts which have proven successful with some groups of clients may not be applicable to those individuals with more substantial handicapping conditions. The intent of the present study was to identify these factors, both those of the clients, as well as DVR, which were contributing to negative closure. This is seen as a first step in altering these contributing factors so that all mentally retarded clients normally referred to DVR will have the opportunity to receive and benefit from those services to which they are entitled.

257 Establishment of the High-Risk Population Laboratory

FY 1976
Status: Continuing
Dates: June, 1966-June, 1975
Cost: Annual $35,677 Projected Total $1,725,000
RT Annual $13,349 RT % of Annual Total 82%
Annual Report Reference: #10, Page 6, R-1

Principal Investigator:	**Rick F. Heber, Ph.D.**	
FY 1977		
Status:	**Continuing**	
Dates:	**June, 1966-June, 1978**	
Cost:	**Annual $128,533** **RT Annual $69,552**	**Projected Total $2,110,599** **RT % of Annual Total 54%**
Annual Report Reference:	**#11, Page 5, R-1**	

OBJECTIVES: Establishment of a High-Risk Population Category (Milwaukee Project) is a longitudinal study of the prevalence of mental retardation in a depressed urban area and the effects of a comprehensive rehabilitation program in preventing mental retardation.

METHODOLOGY:

1. The high-risk population laboratory was established with the aid of a door-to-door survey conducted in an area of metropolitan Milwaukee which had been previously identified as having an extremely high prevalence of retardation.
2. All members of the survey family, both children and adults, received an individual intellectual appraisal in addition to receiving several experimental learning and language tests. In addition, extensive data was obtained on family, social, education, and occupational history and status.
3. From this population pool samples are selected with the characteristics required by the individual studies being undertaken by the "high risk" population laboratory.
4. The population laboratory survey, over a period of a year, contacted all women residents in the area at the time of child birth. All family members were subsequently individually evaluated when the mother was suspected of retardation on the basis of post delivery intellectual screening. This has made accessible a substantial number of mentally retarded young adults and their offspring.

FINDINGS TO DATE: The data derived from the project during the current grant period further extends previously reported data which has presented the indication that the high prevalence of mental retardation found among disadvantaged population groups is accounted for, largely, by relatively small proportions of the population involved. (This research approach was initially established as a unique focus of the research program of the Center when little knowledge was available about the relationship of poverty to mental retardation.) Based upon this accumulated data, results show that the use of comprehensive rehabilitation of high risk families, families with a high prevalence of mental retardation, must be deemed a successful approach to the prevention of mental retardation.

The Center's second research category entitled "Learning Processes" consists of 16 language and learning activities which are conducted in conjunction with R-1 (Milwaukee Project) and which follows in the Directory. These research activities assess the development of children in a comprehensive family rehabilitation program and compares them to those who have not. In summary, the data continues to show more developmentally sophisticated patterns of responding on all measures of learning of the experimental group.

APPLICABILITY: Comprehensive family rehabilitation when used as an early intervention technique can effectively prevent mental retardation in high-risk children and can effect positive improvement in life skills of other members of the family.

258 Crisis Intervention Rehabilitation Applied Research Program for the Severely Developmentally Disabled

FY 1976 Status:	Proposed	
Principal Investigator:	**William I. Gardner, Ph.D.** **and Orv Karan, Ph.D.**	
FY 1977		
Status:	**Continuing**	
Dates:	**April, 1975-March, 1978**	
Cost:	**Annual $102,332** **RT Annual $60,902**	**Projected Total $306,996** **RT % of Annual Total 59%**
Annual Report Reference:	**#11, Page 94, R-40**	

OBJECTIVES: The major objectives of the applied programmatic research are: (1) to develop and evaluate rehabilitation procedures for use with the difficult developmentally disabled client, (2) to develop methods for the more efficient utilization of vocational rehabilitation personpower, (3) to develop methods for the more efficient utilization of vocational rehabilitation techniques to deinstitutionalize more of the developmentally disabled, and (4) to improve the quality of inter-agency linkages.

METHODOLOGY: Most of the research presently being conducted in this project is of an applied clinical nature. The main aim of this type of research is the assessment, treatment, and adjustment of the client for whom the research is done. This is different from other research which seeks information which does not benefit those persons who take part. This does not mean, however, that the applied clinical research conducted will not have implications beyond the client concerned. Each client served becomes the subject of an experiment where the sample size is one. Repetition of the procedures and results in other single-subject experiments help to confirm the generalizability of the findings and improve the overall external validity of the research.

In all cases, as clinical research studies within the project are planned, not only is a great deal of time focused on identifying the most appropriate designs for minimizing and controlling alternative rival hypotheses, but the procedures themselves are considered in terms of their practicality, feasibility, and utility within traditional rehabilitation centers and facilities. Further, measurement methods are selected which can be handled in typical applied, naturalistic settings. Thus, the research emphasis is on practical rather than statistical significance with a concurrent emphasis on vocational and social-personal behavior improvement.

The basic applied research strategy is one of designing highly individualized behavior change programs for each client based on his/her unique physical/psychological characteristics. The programs consist of a series of hypotheses about types of problems present, what they are relating to, and training program components which could best deal with the presenting problems. These hypotheses are stated in applied learning terms. A functional analysis of behavior approach is used to evaluate the adequacy of these hypotheses. Each client served produces considerable applied research information that has direct and immediate applicability to the types of problems presented by severely developmentally disabled persons.

FINDINGS TO DATE: On the basis of the work completed to date there have been many demonstrations that the principles and procedures of behavior management can be effective tools for improving functional vocational and social skills of the severely developmentally disabled. The tri-setting data-based developmental habilitation model of the Crisis Intervention Project appears to represent one example of the value of a coordinate and integrative network of habilitation transitional environments for maintaining and generalizing appropriate social/vocational client behaviors.

For those with the most severe disabilities, inter-agency planning and coordinated programming are absolutely essential. Systematic and consistent inter- and intra-programming efforts which complement and augment each other are critical factors in the deinstituionalization and habilitation of the severely developmentally disabled.

In spite of the new legislation with its emphasis on the more severely disabled, there seems to be a continuing trend among vocational rehabilitation agencies to unfairly discriminate in favor of clients who enter the vocational rehabilitation system with an adequate repertoire of prevocational and social-interpersonal skills. Those attempting to enter the system with substantial deficiencies in these areas are usually not given appropriate nor sufficient opportunities for demonstrating their capabilities. Specialized intervention programs, such as the Crisis Intervention Center, which utilize data-based behavioral procedures, may bring new meaning to the concept of extended evaluation and provide more vocational rehabilitation opportunities to the more severely developmentally disabled.

APPLICABILITY: The problems presented by the clients participating in this project are considered to be similar in nature to the problems presented by those developmentally disabled persons who vocational rehabilitation agencies usually consider to be hard-to-rehabilitate, and, in many cases, unfeasible for services. The applied nature of the research is designed to provide assistance not only to the clients that are presently participating in the project, but also to the counselors in the field who are presently faced with similar problems among their developmentally disabled clientele.

Since it may be expected that severely developmentally disabled clients will be coming to the attention of vocational rehabilitation agencies in greater numbers than they ever have before, it would appear that the time is right to reconsider some of the traditional evaluation and treatment procedures which have been used with more of the routine cases. The work within the Crisis Intervention project to date has continued to demonstrate that with appropriate evaluative and remediational strategies, it is possible to incorporate traditionally difficult clients into the rehabilitation system.

259 A Longitudinal Study of the Social, Vocational, Legal and Family Status of Young Adult Mentally Retarded

FY 1976 Status:	Proposed	
Principal Investigator:	**Rick F. Heber, Ph.D.**	
FY 1977		
Status:	**Continuing**	
Dates:	**April, 1975-March, 1981**	
Cost:	**Annual $74,000** **RT Annual $48,816**	**Projected Total $440,000** **RT % of Annual Total 66%**
Annual Report Reference:	**#11, Page 192, R-41**	

OBJECTIVES: The question remains as to what can be done to reduce this problem. It would first be necessary to develop detailed information about this population of retarded adolescents and young adults. We need to know who they are, the nature of their social and educational development, the characteristics of their family etc., and most importantly the factors which lead to social and legal difficulties and vocational inadequacy. Subsequently, a program of ameliorative action would be implemented and tested. The program would attempt to intervene in these individuals' lives in order to effectively minimize or prevent the development and manifestation of serious problems of adjustment.

METHODOLOGY: The implementation of this study first requires the identification of such individuals. Cooperation of the public school and local social agencies will be enlisted. A group of adolescents will be identified and closely studied. We will attempt to follow them upon termination of schooling for at least two years to determine the factors influencing social, vocational, emotional, legal and family problems.

Subsequently (i.e. subsequent to identification but prior to the two year study) we will divide the group into two comparable groups in order to test the effectiveness of our intervention program. One group will remain untreated and only observed for comparison purposes to our treated group. The program of intervention for the treated group will test a variety of approaches to prevent the occurrence of these difficulties, such as through (1) crisis intervention, (2) continuing supportive guidance, (3) environment manipulation, and (4) adult education.

FINDINGS TO DATE: NA

APPLICABILITY: NA

University of Arkansas (RT-13)
Vocational Rehabilitation Research and Training Center

CORE AREAS

Rehabilitation Counseling

The discovery and development of knowledge and skills resulting in greater effectiveness of rehabilitation counselors as helpers with clients demonstrating psychosocial and vocational difficulties.

Psychosocial Treatment Strategies

The discovery and development of psychosocial treatment programs specifically for use by rehabilitation practitioners with clients, and the modification of existing treatment programs for the special needs of rehabilitation settings or specific rehabilitation populations.

Program Evaluation

The discovery and development of procedures and techniques for systematically evaluating the effects of rehabilitation services on client adjustment.

UNIVERSITY OF ARKANSAS

Vernon L. Glenn, Ed.D., Director
University of Arkansas
Arkansas Vocational Rehabilitation
Research and Training Center
West Avenue Annex
346 North West Avenue
Fayetteville, Arkansas 72701

PROJECT TITLES BY FY 1977 STATUS

COMPLETED

Abstract No.

Handbook of Behavior Management: Procedures for Psychosocial Problems in Rehabilitation (Former Title: Development of a Rehabilitation Psychosocial Handbook) (Jack Marr, Ph.D.) 260

Facilitative Staff Attitudes Toward Disabled Persons (Conrad C. Krauft, PH.D.) 261

Rehabilitation of the Rural Public Assistance Recipient at a Comprehensive Rehabilitation Center (Reed Greenwood, Ed.D.) 262

Expanded Public Assistance/Vocational Rehabilitation Service for Rural Public Assistance Recipients (Conrad C. Krauft, Ph.D.) 263

Rehabilitation/Public Assistance Worker Attitudes and Client Outcome (Reed Greenwood, Ed.D.) 264

Counselor Psychological Change Following In-Service Training and Client Contact (Former Title: Rehabilitation Service Delivery to Title XVI Clients in a Service for the Blind Agency) (Conrad C. Krauft, Ph.D.) 265

A Replication of Eber's Multivariate Analysis of a Vocational Rehabilitation System (Conrad C. Krauft, Ph.D.) 266

Preparation of a Training Manual: Psychology of Deafness (Brian Bolton, Ph.D.) 267

Review and Analysis of Drug Treatment Literature (Richard Roessler, Ph.D.) 268

Program Evaluation Methods for State Vocational Rehabilitation Agencies (Stanford E. Rubin, Ed.D.) 269

A Pattern-Probability Model for Predicting Client Outcome (Dennis Bonge, Ph.D.) 270

Facilitative Case Management in Rehabilitation (Stanford Rubin, Ed.D.) 271

Homogeneous Sub-scales for the Mini-Mult (Brian Bolton, Ph.D.) 272

Serving Deaf Rehabilitation Clients: Fundamentals of Communication (Former Title: Communication with the Deaf: A Training Packet for Rehabilitation Workers with the Adult Deaf) (B. Douglas Rice, Ed.D.) 273

Use of the Work Environment Scale to Describe a Rehabilitation Research and Training Center Environment (Brenda Nobles, Ph.D.) 274

Evaluation of a Physical, Intellectual, and Emotional Personal Adjustment Training Program in Rehabilitation (Richard Roessler, Ph.D.) 275

Summary of the Results of Rehabilitation Counseling Research: 1955-1974 (Brian Bolton, Ph.D.) 276

A Comparison of Differential Modeling Strategies in Counselor Training (Dan Cook, Ph.D.) 277

Development and Evaluation of a Systematic Physical Fitness Training Program for Rehabilitation Clients (Brian Bolton, Ph.D.) 278

The Contributions of Personal Achievement Skills to Work Adjustment Training (Richard Roessler, Ph.D.) 279

A Measure of Suitability of Placement (Paul G Cooper, M.S.) 280

Cluster Analysis of Personality Characteristics of Rehabilitation Clients (Paul G. Cooper, M.S.) 281

Alcohol-Film Bibliography (Gary Simmons, Ed. D.) 282

Survey of Staff Development Activities in State Rehabilitation Agencies (Bob Means, Ph.D.) 283

CONTINUING

Dimensions of Rehabilitation Outcome: A Factor Analystic Study of Several Measures of Client Change (Brian Bolton, Ph.D.) 284

Research on the Psychosocial and Vocational Adjustment of Spinal Cord Injured Clients (Daniel Cook, Ph.D.) 285

The Use of Self-Instructional Training Material with Rehabilitation Personnel (An Evaluation of Vocational Rehabilitation Counselor Functions: A Self Instructional Training Package) (Roy C. Farley, M.S.) 286

Development of a Training Manual on Psychological Aspects of Disability (Brian Bolton, Ph.D.) 287

Development and Evaluation of an Interpersonal Skills Training Package (Robert L. Akridge, Ed.D.) 288

NEW

A Comprehensive Evaluation of the Relationship Between Disability and Personality Functioning: Implications for Rehabilitation Counseling (Brian Bolton, Ph.D.) 289

The Development of an Improved System for Measuring Client Outcome (Paul G. Cooper, M.S.) 290

Evaluation of the RIDAC (Rehabilitation Initial Diagnosis and Assessment for Clients) Project for the Arkansas Rehabilitation Service (Brian Bolton, Ph.D.) 291

Application of Personal Achievement Skills to Personal Adjustment Training for the Blind (Richard Roessler, Ph.D.) 292

Development and Evaluation of a Self-Instructional Physical Fitness Training Program for Spinal Cord Injured Rehabilitation Clients (G. Tim Milligan, M.S.E.) 293

Consumer Involvement and Policy Development Consultation: A Resource Manual for Staff Development Personnel and Rehabilitation Trainers (B. Douglas Rice, Ed.D.) 294

Rehabilitation of the End-Stage Renal Disease Client – Selected Readings (Vernon L. Glenn, Ed.D.) 295

Development and Evaluation of a Training Package in Program Evaluation (Paul G. Cooper, M.S.) 296

Developing a Model for the Analysis of Case Movement in a Vocational Rehabilitation System (Paul G. Cooper, M.S.) 297

Development and Evaluation of a Set of Systematic Training Units to Increase or Decrease Selected Client Behaviors - (Behavior Skills Training) (Robert L. Akridge, Ed.D.) 298

Rehabilitation Counseling: Development and Evaluation of a Comprehensive Counseling and Case Management Model (Stanford Rubin, Ed.D.) 299

Systematic Psychosocial Vocational Treatment Strategies in Vocational Rehabilitation Settings Serving the Severely Handicapped (Robert Akridge, Ed.D.) 300

Program Evaluation Techniques in Vocational Rehabilitation Agencies and Facilities (Reed Greenwood, Ed.D.) 301

The Identification of Factors Affecting Behavioral Competency in a Comprehensive Rehabilitation Center (John Marr, Ph.D.) 302

Increasing Research Utilization Through the Development of Training Packages (Selected Consultants) 303

DISCONTINUED FY 1976

Development of a Published In-service Training Sourcebook – Simulated Counseling Situations for Rehabilitation Counselors: Structured Experiences Based on Critical Incidents in Counselor Interview and Job Performance Behavior (Bill K. Richardson, Ph.D.)

Content of Client Talk in the Rehabilitation Counseling Interview and its Relationships to Counselor Subrole Responses: A Measure of Interview Outcome (Bill K. Richardson, Ph.D.)

Training Manual on Empathy, Respect, and Genuineness: Using Actual Rehabilitation Counseling Interviews (Bob Means, Ph.D.)

A Methodological Study of the Relationship of Counselor Level of Interpersonal Functioning with Client Exploratory Behavior and Client Change in Psychological Functioning (Bill Richardson, Ph.D.)

Counselor Subrole Adaptability and Use: The Relationship of the Appropriateness of Counselor Subrole Behaviors and Patterns of Use with Client Outcome (Bill K. Richardson, Ph.D.)

DISCONTINUED FY 1977

A Longitudinal and Cross-Sectional Investigation of the Intellectual, Emotional, and Vocational Development of Deaf Children and Adolescents in a State Residential School (Arkansas School for the Deaf) (Brian Bolton, Ph.D.)

OTHER

Behavior Analysis Training: A Developmental Program (Being Subsumed under R-152) (Richard Roessler, Ph.D.)

Development of a Goal Setting Module for Facilitative Case Management (Subsumed under R-151) (Richard Roessler, Ph.D.)

Behaviorial Analysis Training: A Developmental Program (Richard Roessler, Ph.D.)

260 Handbook of Behavior Management: Procedures for Psychosocial Problems in Rehabilitation (Former Title: Development of a Rehabilitation Psychosocial Handbook)

Principal Investigator	Jack Marr, Ph.D.	
1976		
Status	Continuing	
Dates	June, 1971- February, 1976	
Cost	Annual $18,427 RT Annual $11,736	Projected Total $25,000 RT % of Annual Total 63.7 %
Annual Report Reference	#11, Page 117, R-13	
1977		
Status:	**Completed**	
Dates:	**June, 1971-October, 1976**	
Cost:	**Annual $19,460** **RT Annual $14,059**	**Projected Total $25,000** **RT % of Annual Total 72.2%**
Annual Report Reference:	**#12, Page 213, R-13**	

OBJECTIVES

1. To orient rehabilitation personnel to psychosocial problems.
2. To aid practitioners in client problem assessment or evaluation and treatment.
3. To provide information on effective methods of communicating problems to clients and rehabilitation professionals.
4. To provide a variety of behavior treatment procedures for the more common problem categories (dependency, immaturity, malingering, aggression, withdrawal, poor work habits).

METHODOLOGY

1. Psychosocial checklist is being developed from rehabilitation client records.
2. Trait behavioral definitions and behavioral quantification tables are being developed from objective tests and interviews with rehabilitation personnel.
3. Treatment procedures are drawn from RT-13 research in behavior modification procedures.

FINDINGS TO DATE During the Fy 76 reporting period, several major modifications were made. As a result of user feedback, treatment techniques contained in the Handbook were narrowed to the use of those under the nomer of Behavior Modification. The traits contained in the Handbook were grouped in six areas as opposed to ten. The Handbook is designed to be used independently by rehabilitation personnel. The section for the coordinator will serve to guide facilities wishing to implement a coordinated behavior modification effort.

The handbook has been completed and is in preparation for printing.

APPLICABILITY The client populations found in rehabilitation facilities often have behavioral problems which retard vocational rehabilitation and decrease chances of holding employment after placement. The severely disabled populations also frequently demonstrate behavioral problems, especially in traumatic cases. To the extent that these behavioral problems can be modified during the facility training experience, the comprehensive goals of rehabilitation have been met.

261 Facilitative Staff Attitudes Toward Disabled Persons

Principal Investigator	Conrad C. Krauft, Ph.D.	
1976		
Status	Completed	
Dates	February, 1970-January, 1975	
Cost	Annual $2,030 RT Annual $1,401	Projected Total $10,000 RT % of Annual Total 69%
Annual Report Reference	# 11, Page 143, R-33	

OBJECTIVES:

Primary: To determine whether staff attitude toward the disabled was related to client outcome.

Secondary: To determine whether staff expressed different attitudes toward specific disability groups, and whether general attitude toward the disabled was correlated with attitudes toward specific disability groups.

METHODOLOGY: Staff sample was comprised of 26 staff members providing services to disabled clients in a comprehensive rehabilitation center. Client sample was comprised of 65 instructors' clients and 173 counselors' clients. Two types of variables were studied: (1) staff attitudes toward disabled, and (2) client program completion vs. no-completion. Staff attitudes were measured using Attitude Toward Disabled Persons Scale (Yuker, Block, & Younng, 1970).

FINDINGS TO DATE: Project concluded. Major findings include: (1) Staff attitudes alone were not a crucial antecedent to positive client outcome. (2) The rehabilitation staff expressed significantly different attitudes toward several of the disability populations. (3) General attitude toward the disabled was significantly correlated with attitudes toward specific disability populations. This finding suggests that there may be a general underlying attitude that accounts for the specific attitudes.

APPLICABILITY: State agency administrative staff, state agency inservice training personnel, agency supervisors, counselors, and rehabilitation researchers targeted as direct consumers of project results.

262 Rehabilitation of the Rural Public Assistance Recipient at a Comprehensive Rehabilitation Center

Principal Investigator:	Reed Greenwood, Ed.D.	
1976		
Status:	Completed	
Dates:	January, 1969-February, 1975	
Cost:	Annual $12,697 RT Annual $8,760	Projected Total $85,000 RT % of Annual Total 69%
Annual Report Reference:	#11, Page 151, R-75	

OBJECTIVES: (1) To evaluate a treatment program for rehabilitation center involved welfare clients, and (2) to compare these clients with other matched groups of rehabilitation and non-rehabilitation clients to determine most effective treatment methods.

METHODOLOGY:

1. The effectiveness of the treatment program was determined by the measurement of pretreatment to post-treatment changes as measured by a client's self-report and psychometric evaluation. Data on the placement possibilities, employability, and cost-benefits of job outcome are also being noted for each client. In addition, data collected by state agencies and various welfare agencies regarding the client's status and vocational outcome were considered.
2. All psychometric and self-report measures were administered upon admittance to the treatment program and re-administered upon completion of the treatment. The Structured Interview Inventory was given at a six month follow-up following discharge from the rehabilitation center. Thus, for welfare recipients, differential rehabilitation outcomes and patterns of change were examined in relationship to the intervention strategies being posed.

FINDINGS TO DATE:

1. It was found that the rural, culturally disadvantaged welfare recipient (black, female) can be as successfully rehabilitated as other client populations. In addition, they can as successfully utilize the Center's programs as can the physically and emotionally handicapped.
2. Various rehabilitation outcomes were perceived for clients with varying demographic characteristics.
3. Older, short-term clients receive more benefit from the Center's programs than do other clients.
4. The benefits received from participating in the Center's comprehensive program include an increased knowledge of existing resources, a change in work attitude, increased knowledge of vocational skills, and knowledge of how to budget available resources.

5. Decreased welfare recipiency and job interviews relate to increased employment.

APPLICABILITY: The project was directly concerned with developing and assessing innovative programs in a comprehensive rehabilitation center to rehabilitate public assistance recipients. The service component involves direct services to this client population, and the results should be generalizable to other similar populations.

263 Expanded Public Assistance/Vocational Rehabilitation Service for Rural Public Assistance Recipients

Principal Investigator: Conrad C. Krauft, Ph.D.
1976
Status: Completed
Dates: January, 1972-June, 1975
Cost: Annual $12,697 Projected Total $40,000
RT Annual $8,760 RT % of Annual Total 69.0%
Annual Report Reference: #11, Page 177, R-87

OBJECTIVES:

1. To increase the number of individuals moving from the state of dependency on public assistance to a state of independence through gainful employment;
2. to expand the scope the depth of rehabilitation services to disabled public assistance recipients and applicants in the state;
3. to develop and utilize innovative means of handling the problems of public assistance recipients and applicants;
4. to improve rehabilitation placement services for public assistance recipients and applicants;
5. to strengthen existing cooperative relationships between the Division of Rehabilitation Services and the Department of Social Services;
6. to alleviate the poverty conditions affecting the lives of project clients;
7. to evaluate the effectiveness of the expansion program procedures and the achievement of the project's objectives.

METHODOLOGY: Pre and post-test and follow-up data were obtained on the sample of welfare clients. The following four types of variables were studied in the analyses: (1) psychological, (2) demographic, (3) staff rating on prognostic variables of rehabilitation on success, and (4) client service variables.

FINDINGS TO DATE: Project completed. Some significant findings include:

1. Clients served by the welfare expansion project benefited as much as, or more than, clients served by the traditional state-federal program. Over 80% of clients accepted for services were successfully rehabilitated.
2. Rehabilitation and social service personnel (using the prognostic instrument) were unable to predict which clients would benefit more from services.
3. Client psychological characteristics assessed during referral were not significantly related to rehabilitation success.
4. Satisfaction with rehabilitation services were positively correlated with whether or not client was working 6 months following job placement. Clients who were working were more satisfied with services.

APPLICABILITY: Administrators of various levels of social and rehabilitation services should find the results helpful in developing service programs or improving service delivery in established programs. Practitioners may find answers to questions which arise in serving this type of population. Researchers may wish to replicate the study (as designed or with modification) with their own populations.

264 Rehabilitation/Public Assistance Worker Attitudes and Client Outcome

Principal Investigator 1976	Reed Greenwood, Ed.D.	
Status:	Completed	
Dates:	January, 1972-May, 1975	
Cost:	Annual $2,031 RT Annual $1,401	Projected Total $8,000 RT % of Annual Total 69%
Annual Report Reference:	#11, Page 89, R-88	

OBJECTIVES: To assess psychological characteristics of staff who offer rehabilitation services to welfare clients and to compare these characteristics to the same characteristics in a control group of rehabilitation counselors and welfare caseworkers.

METHODOLOGY:

1. Twenty-five newly employed rehabilitation staff members serve as the experimental group, while fifty state agency workers serve as the control group.
2. Each person was tested to determine open-mindedness, perception of welfare client work attitudes, attitudes toward welfare clients and black persons, willingness to accept personal limitations, and interpersonal values.
3. The level of functioning of project staff on the measurement instruments, in relation to level of functioning of control group, determined whether project staff functioned at a more positive level, thereby providing more optimal services to welfare clients.

FINDINGS TO DATE: Project completed. Major findings include:

The direct service project staff—

1. had more positive attitudes toward welfare clients and blacks than did the control group.
2. had more positive perceptions of welfare clients' work attitudes than did the control group.
3. expressed greater willingness to accept personal limitations than did the control group.
4. expressed less open-mindedness than did the control group.
5. expressed more conformity and benevolence and less recognition and leadership than did the control group.

Findings 1, 2, and 3 show the direct service staff to be more psychologically suited to work with welfare clients. Finding #4 shows them to be less psychologically suited, and finding #5 is inconclusive, based upon these interpersonal values, as to which group is more psychologically suited.

APPLICABILITY: The results of the study should have applicability toward reducing the disability of welfare clients by allowing the selection of personnel who are more positive in their attitudes toward this particular population and who demonstrate those attributes which enable them to benefit from training designed to assist counselor candidates to implement a more flexible and creative rehabilitation plan for agency welfare clients.

265 Counselor Psychological Change Following In-Service Training and Client Contact (Former Title: Rehabilitation Service Delivery to Title XVI clients in a Services for the Blind Agency)

Principal Investigator: 1976	Conrad C. Krauft, Ph.D.	
Status:	Completed	
Dates:	January, 1974-December, 1974	
Cost:	Annual $2,540 RT Annual $1,752	Projected Total $2,540 RT % of Annual Total 69%
Annual Report Reference:	#11, Page 197, R-113	

OBJECTIVES: To assess the degree of psychological change exhibited by newly trained counselors after a combination of training and 8 months of providing services to Title XVI clients.

METHODOLOGY: Pre-test, Post-test comparison of experimental and control groups. Experimental group counselors received a one month training program which provided them with information concerning services available (in general) and specialized information for serving Title XVI clients. Training was followed by 8 months of contact with Title XVI clients.

Control counselors did not receive special training and did not have a specialized caseload of Title XVI clients.

FINDINGS TO DATE: Project completed. Major findings were:

(1) The training group did not exhibit psychological change on most of the measures. (2) The control group exhibited no change on any of the psychological measures except willingness to accept their personal limitations.

APPLICABILITY: Applicable to staff development personnel — provides some informational feedback on the influence of training upon participating staff and provides one model for assessing the impact of a training program. This particular project was requested by the Deputy Commissioner for Arkansas Rehabilitation Services for the Blind.

266 A Replication of Eber's Multivariate Analysis of a Vocational Rehabilitation System

Principal Investigator	Conrad C. Krauft, Ph.D.	
1976		
Status	Completed	
Dates	January, 1974-December, 1974	
Cost	Annual $3,048 RT Annual $2,013	Projected Total $3,048 RT % of Annual Total 69.0%
Annual Report Reference	#11, Page 203, R-114	

OBJECTIVE: To identify those client psychological characteristics measured early in the rehabilitation process that predict client case service outcome.

METHODOLOGY: Each of 148 clients completed 3 self-report inventories which assessed self-concept, psychopathology, and normal functioning. The criterion groups consisted of 124 clients who were closed in competitive employment and 24 clients who were closed unemployed after appropriate services had been rendered.

A preliminary factor analysis of the psychological variables from the 3 inventories was run. The factor scores were then correlated with the criterion for the total sample, and the emotionally disturbed and physically disabled subsamples. Ten routinely collected R-300 demographic variables were also correlated with the criterion, for comparative purposes.

FINDINGS TO DATE: Project completed. Findings include:

1. Seven factors were identified — Self-concept, Psychosis, Neurosis, Evia, Anxiety, independence/Super-ego Strength, and Cortertia.
2. When the 7 psychological factors were correlated with the criterion, only one relationship approached significance — Cortertia.
3. When correlations were calculated for the mentally disabled and physically disabled clients separately, no significant relationships with the criterion appeared.
4. One demographic variable, Public Assistance (recipient) correlated significantly with the criterion for the total group.
5. Source of support correlated significantly with outcome for both mentally and physically disabled clients.
6. Younger mentally disabled clients were less likely to be employed.
7. Physically disabled clients receiving public assistance were less likely to be employed.

APPLICABILITY: Results provide the rehabilitation professional with information concerning the relationship (or lack of) between client psychological status at intake and subsequent client case service outcome.

267 Preparation of a Training Manual: Psychology of Deafness

Principal Investigator:	Brian Bolton, Ph.D.	
1976		
Status:	Completed	
Dates:	January, 1974-September, 1975	
Cost:	Annual $2,540 RT Annual $1,752	Projected Total $4,500 RT % of Annual Total 69%
Annual Report Reference:	#11, Page 209, R-116	

OBJECTIVE: To develop a self instructional training manual for use by counselors and other practitioners who work with deaf clients. The manual emphasizes emperical research studies which provide a base for substantive conclusions about the psychological development of deaf persons.

METHODOLOGY: The nine chapters, written by acknowledged experts, are: (1) Introduction, (2) Lauguage and Communication, (3) Personality and Social Development, (4) Intellectual Development, (5) Academic Achievement, (6) Vocational Development, (7) Psychiatry and Problems of Deafness, (8) Rehabilitation Programs, and (9) Early Intervention Programs.

FINDINGS TO DATE: Manual has been completed.

APPLICABILITY: Provides a knowledge of the psychological impact of deafness, which is essential to the provision of optimal services to deaf clients.

268 Review and Analysis of Drug Treatment Literature

Principal Investigator:	Richard Roessler, Ph.D.	
1976		
Status:	Completed	
Dates:	January, 1974-July, 1975	
Cost:	Annual $5,080 RT Annual $3,505	Projected Total $10,000 RT % of Annual Total 69%
Annual Report Reference:	#11, Page 213, R-117	

OBJECTIVES:

1. To complete an annotated bibliography of drug treatment and rehabilitation studies;
2. to review drug rehabilitation literature to identify current treatment needs;
3. to develop an outline for a comprehensive treatment and rehabilitation program for drug abuse.

METHODOLOGY: Over one hundred articles on drug abuse rehabilitation were collected. These articles were annotated and grouped in a bibliography. This bibliography provides an extensive overview of drug treatment literature during the years 1968-1974.

FINDINGS TO DATE: An extensive review of the literature and annotations of the majority of the collected articles has been completed.

The Annotated Bibliography has been completed and published by ARR&TC.

APPLICABILITY: Those involved in the treatment of drug abusers will find in the bibliography numerous suggestions regarding developments in the drug treatment field.

269 Program Evaluation Methods for State Vocational Rehabilitation Agencies

Principal Investigator:	Stanford E. Rubin, Ed.D.	
1976		
Status:	Completed	
Dates:	June, 1974-June, 1975	
Cost:	Annual $38,092	Projected Total $41,000
	RT Annual –	RT % of Annual Total –
Annual Report Reference:	#11, Page 219, R-118	

OBJECTIVES:

1. To review, develop, and field test evaluation methodologies for state vocational rehabilitation agency programs;
2. to report the findings of the processes and results involved in the above objective to all interested rehabilitation agencies and practitioners.

METHODOLOGY:

1. Representatives from state vocational rehabilitation agencies, RSA, and the Arkansas RT Center convened to plan a national conference on general performance standards for state vocational rehabilitation agencies.
2. The faculty of the Arkansas RT Center prepared a literature review based upon the directions established by the planning conference.
3. A national conference utilizing group work sessions and involving specialists from RSA, the Arkansas RT Center, and all state vocational rehabilitation agencies was convened.
4. The faculty of the Arkansas RT Center edited and published the report of the conference and distributed copies to RSA designees.
5. RSA designees field tested the instruments for collecting data on performance relative to general standards.
6. Arkansas RT Center faculty edited and summarized the findings of the field testing for presentation at a second national conference.
7. A second national conference was held to present and review the findings of the field testing to all interested rehabilitation agencies, researchers, etc.
8. Arkansas RT Center faculty published and disseminated a final report on the entire project.

FINDINGS TO DATE: Project completed. Some findings are:

1. A relationship was found between client characteristics (severity of disability, race and sex) and time on caseload, suggesting it would be difficult to determine timeliness of service delivery merely by number of months in status(es).
2. Case review based judgements are superior to time-in-status judgements for determining undue delay.
3. Case folder information was found to be inadequate in 4 separate PE studies.
4. Many agencies had difficulty retrieving data on average cost per service.
5. Client satisfaction research has provided support for the quality of rehabilitation services, but has failed to shed much light on the correlates of client satisfaction.
6. A great majority of state agencies provide post-employment services.
7. Findings of a follow-up study showed that clients closed in Status 28 or 30 indicated that the reason for their failure to achieve rehabilitation success was the severity of their disability.

APPLICABILITY: The project concerns the evaluation and field testing of program standards of performance for all federally funded VR programs. It should, therefore, have implications for the determination of future assessment techniques used in rehabilitation.

270 A Pattern – Probability Model for Predicting Client Outcome

Principal Investigator:	Dennis Bonge, Ph.D.	
1976		
Status:	Completed	
Dates:	July, 1974-December, 1974	
Cost:	Annual $12,024 RT Annual $9,296	Projected Total $12,024 RT % of Annual Total 69%
Annual Report Reference:	#11, Page 229, R-119	

OBJECTIVE: To evaluate a pattern-probability model for predicting client outcomes using qualitative data.

METHODOLOGY:

1. The sample consisted of all clients accepted for rehabilitation services by the Arkansas Rehabilitation Services whose cases were closed during the first eleven months of 1972.
2. Variables were the bibliographic data collected at the start of rehabilitation and at closure.
3. A multiple linear regression analysis and an analysis based on a pattern-probability model were conducted.

FINDINGS TO DATE: Project completed. A manuscript has been prepared for a Research Report. In the first part of the paper an attempt is made to classify the major objections to the closure system presently used by the State-Federal vocational rehabilitation program. A review of the rehabilitation literature established that most objections to the closure system fall into one or two categories (a) the closure system allows only a very gross distinction between successful clients and unsuccessful clients (b) the closure system gives no extra credit to counselors and agencies for accepting difficult cases.

The major focus of the paper, however, is to illustrate an approach to designing a closure system that satisfies the above two objections. First, by means of a miniature example, then, by means of a rather extensive empirical study, a closure system is developed that is quite flexible. The suggested closure system employs a discretionary number of indices of rehabilitation success which could potentially range from crude "success-failure" dichotomies to indices that measure rehabilitation success to any desired degree of subtlety. The system operates using existing R-300 reporting conventions yet producing indices of success tailored to specific needs. Integral to the approach is a general method of actuarially determining weights for case difficulty based on R-300 experience.

APPLICABILITY: If certain individuals can be identified at acceptance as having relatively low probability of becoming rehabilitated then special attention can be given to the individuals at an early stage in the rehabilitation process.

271 Facilitative Case Management in Rehabilitation

Principal Investigator:	Stanford Rubin, Ed.D.	
1976		
Status:	Continuing	
Dates:	August, 1974-December, 1975	
Cost:	Annual $12,557 RT Annual $6,508	Projected Total $15,000 RT % of Annual Total 51.8%
Annual Report Reference:	#11, Page 129, R-122	
1977		
Status:	**Completed**	
Dates:	**August, 1974-December, 1976**	
Cost:	**Annual $1,483** **RT Annual $1,072**	**Projected Total $10,000** **RT % of Annual Total 72.3%**
Annual Report Reference:	**#12, Page 217, R-122**	

OBJECTIVES:

1. To provide training in facilitative case management to practicing rehabilitation counselors in a state vocational rehabilitation agency;
2. to assess the change in counselor functioning as a result of this training;
3. to prepare written research reports to disseminate the research findings.

METHODOLOGY: Fourteen Wisconsin DVR alcoholism specialist counselors were randomly divided into an experimental and a control group. The experimental group received Facilitative Case Management training in September, 1974 and again in January, 1975. Control group counselors received no training.

Counselors of both groups were instructed to send in tape-recorded interviews at 3 points in time: 1) prior to training, 2) between first and second training programs, 3) following second training program. As a result of limited counselor response to this request, the sample became too small to yield meaningful data from tape rating. The original plan called for rating of all interviews on Empathy, Respect and Genuineness. Experimental and control group counselors were to be compared on measuring of client satisfaction, personality change and drinking behavior.

FINDINGS TO DATE: Due to insufficient data (taped interviews) the major purpose of the study could not be achieved. Counselors' perceptions of the effectiveness of each of the two FCM training sessions were as follows:

First training session:

1. highest on relevancy to job role
2. lower ratings on program organization
3. training time should be extended
4. more opportunity for trainee participation should be included.

Second training session:

1. trainees felt the FCM model was applicable to their caseloads
2. trainees would use the model in preference to methods and techniques previously learned
3. rated by trainees as good to excellent
4. trainees wanted additional training with emphasis on taped role-playing and group critiques
5. training should be five instead of three days.

APPLICABILITY: Since the rehabilitation counselor serves as a principal change agent in the rehabilitation process, the services he provides constitute a significant factor in the success of the program. This research involves testing a model which is proposed as effective in increasing rehabilitation counseling skills.

272 Homogeneous Sub-scales for the Mini-Mult

Principal Investigator:	Brian Bolton, Ph.D.	
1976		
Status:	Completed	
Dates:	July, 1974-June, 1975	
Cost:	Annual $2,540 RT Annual $1,752	Projected Total $2,600 RT % of Annual Total 69%
Annual Report Reference:	#11, Page 233, R-123	

OBJECTIVES:

1. To review the literature for psychometric studies of the Mini-Mult;
2. to assess the dimensionality of the Mini-Mult;
3. to develop independent, homogenous subscales for the Mini-Mult.

METHODOLOGY:

1. The sample consisted of 312 rehabilitation clients who were subjects in a nationwide study of the counseling process.
2. The variables were the 71 items of the Mini-Mult.
3. A factor analysis of the item-intercorrelation matrix was carried out.

FINDINGS TO DATE: Project completed. Identification of three Mini-Mult subscales was based on comparisons with the results of two previously reported factorial studies of the 373 item form of the MMPI (Barker, Fowler, and Peterson, 1971; Hunter, Overall, and Butcher, 1973) and a diagnostic assembly of items based on Comrey's factor analyses of clinical scales of the MMPI (Baggaley and Riedel, 1966). The Mini-Mult subscales overlap substantially with three or four subscales developed in each of the three selected studies. The first subscale, which contains a mixture of psychasthenia, hysteria, depression, and hypomania items, was identified as Low Morale. The second subscale taps the client's neurotic concerns with body symptoms and contains items with primary content in the areas of hypochondriasis, hysteria, and hypomania, leading to the label of Somatization. The third subscale consists of items which reflect paranoid concerns and reality distortion leading to the designation of Psychotic Distortion-Paranoia.

APPLICABILITY: This brief, easily scored and interpreted form of the Mini-Mult can be used to improve the assessment of extent of pathology present in the psychological adjustment of clients at the time of acceptance for services as well as at closure. Thus, a diagnostic aid and a pretest/posttest measure are available in one instrument.

273 Serving Deaf Rehabilitation Clients: Fundamentals of Communication (Former Title: Communication with the Deaf: A Training Packet for Rehabilitation Workers with the Adult Deaf)

Principal Investigator:	B. Douglas Rice, Ed.D.	
1976		
Status:	Completed	
Dates:	April, 1974-April, 1975	
[illegible]:	Annual $10,157	Projected Total $10,000
	RT Annual $7,008	RT % of Annual Total 69%
[illegible] Report Reference:	#11, Page 239, R-126	

[illegible]VES:

1. [illegible]o develop a comprehensive and practical packa[illegible]of training materials on communication for rehabilitation workers with the deaf that can be use[illegible] trainers without further creation of materials unless specifically desired;
2. to develop the materials in conjunction with the [illegible]raining Guide outline of the unit on communication in such a way that they can serve as [illegible]odule for a comprehensive, indepth training package.

METHODOLOGY: The project structure must be determined in order to achieve the products; this includes: establishing the scope of the effort, the funding required, the personnel needed, the availability of personnel, the assignment of responsibilities, the time-frame for the project, and the evaluation plan.

1. Development of audience profile (to determine who would use package and receive training).
2. Identification and evaluation of existing materials, sources and costs of materials for possible inclusion in the package.
3. Preparation of annotated bibliography of materials, sources, and costs of materials.
4. Establishment of areas of materials for package.
5. Design and production of materials in form of self-instructional manual for general rehabilitation counselors and other rehabilitation personnel.

FINDINGS TO DATE: Project completed. The training package includes:

1. Annotated bibliography of materials, personnel and institutions which may be contacted for assistance.
2. Self-instructional Training Manual with following contents:
   - a. Understanding Language Acquisition by the Deaf.
   - b. Determining the Clients' Level of Communication.
   - c. How to Communicate with the Client.

APPLICABILITY: The training package was in response to a request by State Coordinators of Deaf Service, Staff Development Personnel, and the 1973 National IRS Conference participants who are responsible for training rehabilitation workers for the deaf.

274 Use of the Work Environment Scale to Describe a Rehabilitation Research and Training Center Work Environment

Principal Investigator:*	Brenda Nobles, Ph.D.	
1976		
Status:	Completed	
Dates:	May, 1974-December, 1974	
Cost:	Annual None RT Annual None	Projected Total None RT % of Annual Total None
Annual Report Reference:	#11, Page 245, R-127	

*Non R&T staff member at time of study completion

OBJECTIVES:

1. To provide normative data for the Work Environment Scale (WES);
2. To provide information concerning the perceived work environment of the Arkansas RT Center (AAR&TC).

METHODOLOGY:

1. The sample consisted of 31 ARR&TC faculty and staff members.
2. The variables were both staff and faculty group membership and responses to Form R (real) and Form I (ideal) of the WES.
3. Forms R and I were administered a week apart. Means and standard deviations for both forms were calculated for both faculty and staff. Profiles of group means on the two forms were then drawn. These were described and distributed to both Hot Springs and Fayetteville groups.

FINDINGS TO DATE: Project completed. Findings include:

1. Faculty and staff of both offices view their respective offices similarly. There were great discrepancies between the faculty and staff in Fayetteville than in Hot Springs. Discrepancies were greatest on the involvement, control, innovative, and physical comfort scales. Faculty members rated involvement, innovative, and physical comfort higher than staff.
2. Staff members in Hot Springs viewed their work environment more positively than did staff in Fayetteville.
3. Faculty members in Hot Springs viewed their work environment more positively than did faculty in Fayetteville.
4. Ideal and real work environments were generally similar for both the Hot Springs and Fayetteville staffs.

5. Faculty at Fayetteville reported more differences between real and ideal work environments, with the Fayetteville faculty reporting autonomy and clarity in their work environment as lower than desired.

APPLICABILITY: Although this research was conducted within an R&T Center, the implications for improved work environments appears to have carry over for other rehabilitation settings. Most rehabilitation organizations have groups of staff members who must work together to achieve organizational goals. The instrument used in this study could be used for self-study within an agency setting to determine how staff view agency cohesiveness, work pressures, control, autonomy, task orientation, and other variables purportedly assessed by the instrument.

275 Evaluation of a Physical, Intellectual, and Emotional Personal Adjustment Training Program in Rehabilitation

Principal Investigator: Richard Roessler, Ph.D.
1976
Status: Completed
Dates: July, 1974-February, 1975
Cost: Annual $5,290 Projected Total $5,290
RT Annual $3,688 RT % of Annual Total 69.7%
Annual Report Reference: #11, Page 249, R-128

OBJECTIVES:

1. To assess client gain in physical, intellectual, and emotional areas in both an experimental and a traditional personal adjustment program;
2. to identify and compare individuals with differing degrees of change in the physical, intellectual, and emotional areas;
3. to isolate those factors that are most predictive of change in a physical, intellectual, and emotional training program;
4. to recommend procedures for more effectively carrying out physical, intellectual, and emotional training;
5. to recommend techniques for better evaluating the impact of physical, intellectual, and emotional training.

METHODOLOGY:

1. Experimental and control samples of male and female general rehabilitation clients at the Hot Springs Rehabilitation Center were randomly selected for inclusion in the study.
2. Subjects in the systematic personal adjustment training program received fifteen hours of physical, emotional, and intellectual training.
3. Subjects in the control group were involved in the normal process of rehabilitation and personal adjustment training at the comprehensive rehabilitation center.
4. Demographic and psychometric data regarding disability type, intelligence, and achievement were collected.
5. Each client was assessed before and after participating in the study; the variables assessed were behavior, beliefs, physical condition, goals, levels of interpersonal functioning, and self concept. Data was also collected regarding the outcome of clients at the center.

FINDINGS TO DATE: Project completed. Findings include:

Effects of PIE Training

1. Experimental clients gained in physical fitness dimensions during PIE training.
2. Experimental clients were significantly higher in interpersonal skills and goal setting skills at posttesting.
3. No improvement in self-concept as measured by the Tennessee Self-Concept Scale was found.
4. Experimental males tended to improve in sense of personal control more than did control males; no improvement occurred for experimental females.
5. Experimental females tended to improve on counselor behavior ratings, whereas, control females did not; no difference was found in behavior ratings for males.

6. Center outcomes (completed, dropout, disciplinary dismissal, etc.) were comparable in all groups.

Differential Effects of PIE Training

7. For males, improvement in self-concept was not indicative of improvement in other physical, intellectual, and emotional areas; a slight tendency was observed for females who improved in self-concept to have also improved in endurance and dynamic strength.
8. No consistent relationship between Center outcome and improvement or deterioration in self-concept appeared.

Additional information in report includes description of participants and dropouts, initial assessments of participants, qualifications of findings due to limitations in the research methodology, and suggestions for further study of Personal Adjustment Training.

APPLICABILITY: Systematic personal adjustment training represents a concrete strategy for increasing client development in the areas of physical, intellectual, and emotional functioning. This study not only evaluates the impact of this training, but also discusses ways of improving its delivery and evaluation.

276 Summary of the Results of Rehabilitation Counseling Research: 1955-1974

Principal Investigator:	Brian Bolton, Ph.D.	
1976		
Status:	Completed	
Dates:	January, 1975-May, 1975	
Cost:	Annual $7,619 RT Annual $5,257	Projected Total $7,500 RT % of Annual Total 69%
Annual Report Reference:	#11, Page 259, R-129	

OBJECTIVES:

1. To review and summarize the results of rehabilitation research studies conducted during the past 20 years.
2. To discuss in detail the implications for counseling practice.

METHODOLOGY:

a. The following journals and publications will be reviewed: Rehabilitation Counseling Bulletin, Rehabilitation Psychology, Journal of Applied Rehabilitation Counseling, Journal of Rehabilitation, Rehabilitation Record, Rehabilitation Literature, Journal of Counseling Psychology, Journal of Clinical Psychology, Journal of Rehabilitation of the Deaf, Rehabilitation Research and Practice Review, Archives of Physical Medicine and Rehabilitation, Journal of Health and Social Behavior, and all SRS sponsored R9D reports as well as publications of the RRRIs and Vocational R&T Centers.

b. The selected research reports will be briefly summarized using the following topical units:
   1. Interviewing Techniques
   2. Counseling Techniques
   3. Placement Techniques
   4. Vocational Evaluation
   5. Vocational Adjustment
   6. Psychological Evaluation
   7. Vocational Training
   8. Behavior Modification Programs
   9. Personal Adjustment Training
   10. Community Resources
   11. Specific Disability Conditions
   12. Counselor Training

c. The implications of the studies comprising each section will be carefully stated and illustrated where possible. General principles, as well as specific guidelines and suggestions for counseling practices, will be stressed.

FINDINGS TO DATE: Due to the nature of this project, it was completed in part and subsumed in part in other projects involving research in rehabilitation counseling. Rather than complete an entire review of the rehabilitation counseling area, reviews will be conducted in each project within three areas of emphasis of ARR&TC.

The completed activities associated with the project were the preparation of a group of papers for a symposium held at the American Rehabilitation Counseling Association Annual Conference, New York City, March, 1975. Entitled "Rehabilitation Counseling: Current Problems, Needs and Responses", the symposium represented the documentation of existing needs in the field plus responses developed by ARR&TC. This material is also being published in a special-issue of the **Rehabilitation Counseling Bulletin.**

APPLICABILITY: This project was an attempt to improve rehabilitation practices with disabled clients by making the results of research available to the counselor in a utilizable form.

277 A Comparison of Differential Modeling Strategies in Counselor Training

Principal Investigator: Dan Cook, Ph.D.
1976
Status: Completed
Dates: January, 1975-September,1975
Cost: Annual $7,618 Projected Total $7,618
RT Annual $5,256 RT % of Annual Total 69%
Annual Report Reference: #11, Page 265, R-130

OBJECTIVES:

1. To compare VBI modeling strategy and expert modeling with a third modeling module (essentially a mix of VBI and expert modeling training) in decreasing counselor interview related anxiety and increasing counselor tolerance of ambiguity.
2. To evaluate various trainee expectations and attitudes towards counseling supervision as they relate to the treatment conditions.
3. To refine the modeling techniques by obtaining trainee input to the content of the presentation.

METHODOLOGY: Master's level rehabilitation students (n=9) saw a series of 4 Vicarious Behavior Induction (VBI) videotapes and graduate student volunteers from other counseling classes (n=9) saw a series of 4 "expert" modeling videotapes. Two VBI and 2 expert modeling videotapes were shown to a third group of graduate level counseling students (n=21). Immediately after viewing a tape, the groups spent 20 minutes discussing the topic. Discussion periods were led by an advanced counseling student who followed a structured format. All tapes were shown over a 4 week time period.

Demographic and psychosocial trainee characteristics were obtained; trainee preference for modeling type was assessed; also measured were counselor anxiety toward a counseling interview, counselor tolerance of ambiguity, and trainee expectations toward counseling practicum supervision. Outcome criteria of pre and post measures on above variables. Statistical analyses included analysis of covariance, analysis of variance t-tests and correlational procedures.

FINDINGS TO DATE: Completed data analysis of the effects of differential modeling strategies on trainee tolerance of ambiguity, anxiety, preference for counseling supervisory style and preference for type of modeling presentation revealed the following findings:

A. There were no significant mean differences between trainees who viewed mixed, VBI or expert modeling videotapes on tolerance of ambiguity, interview related anxiety, or preference for conseling supervisory style.

B. Persons who viewed the expert tapes and had low tolerance of ambiguity and expectations for didactic (or highly structured) supevisory experiences evaluated this modeling experience the highest.

C. In the mixed and VBI groups persons who rated these modeling experiences the highest tended to be more tolerant of ambiguity, less anxious, and endorsed experiential types of supervisory experiences.

D. In general, persons in the expert modeling group saw the tapes as providing specific counselor skills, persons in the VBI group saw the tapes as raising general counseling issues. Two-thirds of all participants said that they found the modeling presentations of value.

APPLICABILITY: The usefulness of modeling strategies to counselor educators and trainers is self-evident. Modeling procedures described, researched, and disseminated in this project could be widely applied throughout the field of rehabilitation.

278 Development and Evaluation of a Systematic Physical Fitness Training Program for Rehabilitation Clients

Principal Investigator	Brian Bolton, Ph.D.	
1976		
Status:	Completed	
Dates:	January, 1975-April, 1975	
Cost:	Annual $508 RT Annual $351	Projected Total $600 RT % of Annual Total 69.1%
Annual Report Reference:	#11, Page 275, R-132	

OBJECTIVES: To develop and evaluate a systematic physical fitness training program which consists of audio-tape lectures, an instructor's manual and a client workbook.

METHODOLOGY: Twenty-four rehabilitation center clients participated in the program which was conducted 3 times weekly for eight weeks. Three types of measures were administered to the subjects.

1. Four tests of physical fitness which assess independent areas of functioning were administered immediately before and after the program.
2. Two personality adjustment inventories were completed by participants before and two months after the program.
3. An Exercise Habits Questionnaire was administered two months following completion of the program to assess extent of carry-over of major principles and activities of the program.

FINDINGS TO DATE: The effects of the systematic physical fitness (PF) training package on 20 medically feasible male clients enrolled in a rehabilitation center can be summarized as follows:

1. The eight week PF training program produced substantial improvement in all areas of fitness: dynamic strength, endurance, cardio-vascular functioning, and flexibility.
2. It resulted in measurable "Carry over" effects: whereas only two of 14 subjects who completed the follow-up questionnarie exercised regularly before the program, eleven exercised three days per week or more afterward.
3. It did not produce any measurable improvement in self-reported personal adjustment. However, the instability of the scales from pretest to posttest renders the interpretation of the measures questionable.

APPLICABILITY: The value of physical fitness training for rehabilitation clients in conjunction with personal adjustment programs has been demonstrated. This project provides rehabilitation personnel with an operational physical fitness training program that facilitates immediate and long-term client gains in physical fitness as well as concomitant improvement in psychosocial adjustment.

279 The Contributions of Personal Achievement Skills to Work Adjustment Training

Principal Investigator:	Richard Roessler, Ph.D.	
1976		
Status:	New	
Dates:	January, 1975-November, 1975	
Cost:	Annual $10,157 RT Annual $7,008	Projected Total $11,000 RT % of Annual Total 69%
Annual Report Reference:	#11, Page 59, R-135	
1977		
Status:	**Completed**	
Dates:	**January, 1975-November, 1975**	
Cost:	**Annual $928** **RT Annual $671**	**Projected Total $11,000** **RT % of Annual Total 72.3%**
Annual Report Reference:	**#12, Page 223, R-135**	

OBJECTIVES:

1. To provide indepth training in Personal Achievement Skills for work adjustment staff at Hot Springs Rehabilitation Center.
2. To develop an evaluation design to study contributions of PAS to work adjustment.
3. To collect and analyze data relative to the effects of PAS.
4. To prepare a research report discussing the role of PAS in work adjustment training.

METHODOLOGY:

1. Random sampling work adjustment clients into an experimental and a control group.
2. Gathering pre-post data on the psychological impact of the PAS program.
3. Obtaining counselor and instructor ratings of the current adjustment of control and experimental clients.
4. Gathering follow-up and outcome data from work adjustment clients in order to judge success in actual employment placements.

FINDINGS TO DATE: Although they must be interpreted in the context of acknowledged limitations in sampling and methodology, the research findings indicate that PAS provides valuable skill inputs in goal setting and interpersonal skills. PAS students made greater gains on self-ratings of life perspective, vocational maturity, vocational functioning, interpersonal maturity, and goal attainment, and, to a lesser degree, on counselor and instructor ratings of adjustment. Clients in the program developed a somewhat more realistic perception of the benefits of work as well as possibly of the barriers that exist in their getting and maintaining a job. In essence, Personal Achievement Skills training coupled with an enthusiastic and well-trained leader can make a definite contribution to work adjustment training for rehabilitation clients.

APPLICABILITY: This proposal discusses one concrete, systematic approach to building adjustment skills and personal motivation for rehabilitation clients. Experiences in the PAS program should enable clients to set and achieve personal goals – a feeling central to the desire for self-sufficiency.

280 A Measure of Suitability of Placement

Principal Investigator:	Paul G. Cooper, M.S.	
1976		
Status:	New	
Dates:	April, 1975-March, 1976	
Cost:	Annual $4,571 RT Annual $3,154	Projected Total $5,000 RT % of Annual Total 69%
Annual Report Reference:	#11, Page 73, R-137	

1977
Status: **Completed**
Dates: **April, 1975-March, 1976**
Cost: **Annual $5,004** **Projected Total $6,000**
RT Annual $3,915 **RT % of Annual Total 78.2%**
Annual Report Reference: **#12, Page 231, R-137**

OBJECTIVES:

1. To construct a quantitative index of suitability of placement, that can be computed from existing R-300 data, for comparing service units within the rehabilitation system.
2. To develop appropriate methods for computation of the indices.
3. To compute this index for a sample of rehabilitated clients from the Arkansas Rehabilitation System and report summary results.
4. To compare different groups of clients with respect to their means placement indices.

METHODOLOGY:

1. Suitability of placement indices will be defined for individual clients, counselor caseloads, and district offices on the basis of R-300 data, geographical location, and personal income data contained in the 1970 Census of the United States.
2. Parametric and/or non-parametric tests for differences in means will be used to compare various groups of clients with respect to their suitability of placement indices. The groups to be compared will be defined by geographical, demographic, and service variables.

FINDINGS TO DATE: Three different suitability of placement indices were defined during FY 1976. The basic index is the ratio of a client's earnings at closure to the average earnings of persons in the general population in the client's same age, sex, and race group. The other two indices were modifications of the basic index involving corrections for average county earnings in the county of referral and the relative size of the county of referral. These modifications have proven to be of limited usefulness. Corrective modifications to the initial index have been proposed and corrections for the base line income data are planned. It is anticipated that these modifications will produce a computationally feasible and easily interpretable index of suitability of placement.

A series of modifications to the original index were investigated during FY 1977, resulting in the development of a satisfactory measure of suitability of placement. This index was computed for all Arkansas clients successfully rehabilitated in FY 1975 and it was established that the mean suitability of placement index differs among groups based on Age, Sex, Disability and Severity of Disability. Further, comparisons were made between the different supervisory areas. Since a certain amount of variation between areas is to be expected merely as a result of differences in caseload mix, these comparisons were made with adjustments for caseload mix variation.

APPLICABILITY: The proposed study is directly related to the R and T Center's program evaluation emphasis area in that it may yield a quantified measure of the appropriateness of counselor and/or agency placements. Further, it directly attacks problems currently given priority in the state agencies' emphasis on evaluation of program effectiveness and client outcome.

281 Cluster Analysis of Personality Characteristics of Rehabilitation Clients

Principal Investigator: Paul G. Cooper, M.S.
1976
Status: New
Dates: April, 1975-March, 1976
Cost: Annual $4,571 Projected Total $4,571
RT Annual $3,154 RT % of Annual Total 69%
Annual Report Reference: #11, Page 79, R-138

1977
Status: **Completed**
Dates: **April, 1975-March, 1976**
Cost: **Annual $5,004** **Projected Total $6,000**
RT Annual $3,915 **RT % of Annual Total 78.2%**
Annual Report Reference: **#12, Page 237, R-138**

OBJECTIVES:

1. To demonstrate the usefulness and applicability of two-way clustering techniques for exploring, organizing and summarizing certain types of rehabilitation agency data.
2. To partition a group of rehabilitation clients into disjoint classes of individuals with similar personality profiles.
3. To partition a group of personality variables into disjoint classes of variables (highly related in the sense that clients in a given personality type tend to answer them similarly).
4. To incorporate appropriate computer programs and documentation for implementation of the clustering techniques into the ARR&TC collection of data processing programs.

METHODOLOGY:

1. A random sample will be chosen from an existing data pool including personality inventories for clients from state rehabilitation agencies.
2. The sample will be analyzed using at least one technique for two-way cluster analysis.
3. The variables will be those items of the Mini-Mult Personality Inventory and selected demographic and service outcome variables.
4. The cluster analysis techniques to be used in the analysis will incorporate agglomerative algorithms based on several standard measures of dissimilarity.
5. A cluster analysis will be performed in an attempt to isolate distinct client personality groups.

FINDINGS TO DATE: During FY 1976 a random sample was drawn from an existing data pool including personality inventories for a collection of clients from state rehabilitation agencies. Several clustering algorithms were investigated in an attempt to isolate meaningful clusters of items from the 71 item Mini-Mult Personality Inventory. An initial clustering has been defined, consisting of seven mutually exclusive and exhaustive clusters of items. Further, from these seven item clusters, several distinct client profiles have been isolated.

Analysis of the data has continued during FY 77 period and alternative theoretical explanations for the clusters found have been considered. Six homogeneous item clusters were identified and labeled. They are: (a) Excessive health concerns, (b) Poor self-concept, (c) Tendency toward reality distortion and paranoia, (d) Undifferentiated neuroticism, (e) Cynicism, and (f) Tendency toward social acquisition. These clusters were compared with earlier scales derived via factor analysis techniques.

Groups of clients were also identified based on their item-cluster score profiles but attempts to theoretically differentiate these groups were inconclusive.

APPLICABILITY: The techniques illustrated by the proposed analysis may prove a useful addition to the repertoire of data analysis techniques possessed by rehabilitation administrators, program evaluators, researchers and planners.

282 Alcohol-Film Bibliography

Principal Investigator: Gary Simmons, Ed.D.
1976
Status: New
Dates: May, 1975-November, 1975
Cost: Annual $2,688 Projected Total $3,000
RT Annual $2,216 RT % of Annual Total 82.4%
Annual Report Reference: #11, Page 111, R-142

1977
Status: **Completed**
Dates: **May, 1975-January, 1976**
Cost: **Annual $465** **Projected Total $5,000**
RT Annual $336 **RT % of Annual Total 72.3%**
Annual Report Reference: **#12, Page 243, R-142**

OBJECTIVES: To produce a sourcebook and critique of alcohol related films for use by researchers, librarians, and rehabilitation personnel.

METHODOLOGY: Locate all film distributors and film users and trace films through written and oral communication.

FINDINGS TO DATE:

1. Three hundred and forty eight titles have been identified and 170 films reviewed.
2. Development of the sourcebook has been completed, designed and prepared for publication.

APPLICABILITY: Useful as a sourcebook for personnel dealing with alcoholics and problem drinkers.

283 Survey of Staff Development Activities in State Rehabilitation Agencies

Principal Investigator: **Bob Means, Ph.D.**
1977
Status: **Completed**
Dates: **March, 1975-October, 1976**
Cost: **Annual $1,083** **Projected Total, $2,000**
RT Annual $804 **RT % of Annual Total 74.2%**
Annual Report Reference: **#12, Page 247, R-156**

OBJECTIVES: To conduct a national survey of staff development activities of state vocational rehabilitation agencies.

METHODOLOGY: Questionnaries were mailed to state directors of the 78 VR agencies with a request that in-service training directors complete the questionnaires and return them to ARR&TC. The questionnaire survey was designed to provide a profile of the organized staff development activities provided to agency employees.

FINDINGS TO DATE: The completed report discusses the tabulated data in response to the following general questions:

1. What are the general characteristics of the in-service training program in state vocational rehabilitation agencies in terms of the methods used, trainers used, and career development plans of employed rehabilitation personnel?
2. What are the characteristics of the training program in which agency personnel participate in terms of training objectives, source of training initiation, length of training, types of trainees, man hours involved, trainers, funding, attendance by private rehabilitation program personnel, plans for repetition, site of training, value of training for trainees, general value of training, and geographic scope?
3. What formal university courses were conducted in which agency personnel participated?

What training programs conducted by various agencies would be helpful and appropriate for other agencies?

There is a tremendous range of the types of training programs being conducted. Further, it is assumed that considerable thought and effort are being devoted to the preparation of different training programs to accomplish similar objectives. There is also a significant variation in the degree of satisfaction with programs addressed to similar objectives. In view of central funding and the existence of basic communication channels, it appears both feasible and cost-effective to seek more standardization of rehabilitation training.

APPLICABILITY: Considerable funds have been expended since 1954 for various training programs for rehabilitation practitioners in the vocational rehabilitation program. Funds have been made available directly to state rehabilitation agencies and other organizations to provide such training. This survey was conceived to provide a national picture of the various training activities engaged in by vocational rehabilitation agency personnel. The results should provide program planners with a tool by which an adequate picture of past training activities can be studied in order to anticipate future needs.

284 Dimensions of Rehabilitation Outcome: A Factor Analystic Study of Several Measures of Client Change

Principal Investigator:	Brian Bolton, Ph.D.	
1976		
Status:	Continuing	
Dates:	January, 1975-June, 1976	
Cost:	Annual $2,540 RT Annual $1,752	Projected Total $4,500 RT % of Annual Total 69.0%
Annual Report Reference:	#11, Page 125, R-121	

1977		
Status:	**Continuing**	
Dates:	**January, 1975-June, 1977**	
Cost:	**Annual $2,782** **RT Annual $2,010**	**Projected Total $7,500** **RT % of Annual Total 72.2%**
Annual Report Reference:	**#12, Page 149, R-121**	

OBJECTIVES: In determining the major dimensions underlying client change and outcome as a result of the provision of rehabilitation services, the project attempts to:

a. delineate the major dimensions of client outcome;
b. operationally define these dimensions using currently available measuring instruments, and;
c. provide program evaluators with a handbook for addressing the criterion problems.

METHODOLOGY:

1. The sample will consist of 120 general caseload clients of the Arkansas Rehabilitation Service.
2. The following data will be collected at acceptance for service and closures: ARS Client Outcome Measure and ARS R-300 Client data.
3. At acceptance and closure clients in the sample will complete the Mini-Mult and the Human Service Scale.
4. Factor analysis of various sets of variables and change scores will be the primary statistical technique.

FINDINGS TO DATE: All clients in the sample have completed the Mini-Mult and Human Service Scale pre-testing. About half of the clients have completed the post-testing phase. The remainder are still receiving rehabilitation services.

APPLICABILITY: The isolation and operational definition of the major dimensions of client outcome will enable program evaluators to place their accountability analyses on a solid scientific foundation.

285 Research on the Psychosocial and Vocational Adjustment of Spinal Cord Injured Clients

Principal Investigator:	Daniel Cook, Ph.D.	
1976		
Status:	Continuing	
Dates:	March, 1974-June, 1978	
Cost:	Annual $16,249	Projected Total $70,000
	RT Annual $11,211	RT % of Annual Total 69.0%
Annual Report Reference:	#11, Page 135, R-125	
1977		
Status:	**Continuing**	
Dates:	**March, 1974-June, 1978**	
Cost:	**Annual $17,792**	**Projected Total $75,000**
	RT Annual $12,854	**RT % of Annual Total 72.2%**
Annual Report Reference:	**#12, Page 153, R-125**	

OBJECTIVES:

1. To design a comprehensive research and evaluation strategy to assess the effectiveness of a model Regional System of Spinal Injury Rehabilitation.
2. To implement Personal Achievement Skills Training with a group of SCI at the Hot Springs Rehabilitation Center.
3. To complete a comprehensive review of the research literature dealing with psychosocial and vocational attributes of the SCI.
4. To implement a comprehensive research and evaluation strategy assessing the effectiveness of a Model Regional System of Spinal Cord Injury Rehabilitation.
5. To describe the sample of SCI persons making use of project services.
6. To assess the extent to which SCI clients' personal, social, and vocational needs are met by the rehabilitation program at the Hot Springs Rehabilitation Center.
7. To compare those SCI clients who successfully complete their vocational training programs with those clients who did not for the purpose of isolating client characteristics which are predictive of success.
8. To devise specific intervention strategies to meet the research defined needs of the SCI.
9. To complete a comprehensive review of psychosocial and vocational research pertaining to the SCI.
10. To measure the non-economic and quasi-economic contributions of the SCI to society.
11. To assess SCI clients' degree of satisfaction with rehabilitation services.

METHODOLOGY: The research design for measuring and monitoring client variables considers assessing the client's economic, environmental, social, and psychological status from entry into the project, through treatment, to project completion. A "repeated measures" design will be used and comparisons of SCI project clients to several other SCI client groups will be made.

FINDINGS TO DATE

1. Evaluation of Personal Achievement Skills training was completed.
2. Objectives of the Arkansas Model Regional System of SCI Rehabilitation Project was clarified and operationalized.
3. A complete research design, including development of several psychometric instruments, was completed.
4. A data collection system was developed and is ready for implementation.
5. A search of the SCI research literature was conducted.

The evaluation and research design have been instigated. Briefly, the evaluation system consists of monthly reports completed by spinal cord project personnel (field counselors and HSRC counselors). These reports are the basis for evaluating whether or not the project meets its stated objectives. In addition, SCI clients, beginning at first referral to rehabilitation services, complete various psychometric instruments and questionnaires as they move through the rehabilitation process.

Preliminary descriptive statistics revealed that those clients seen by field rehabilitation counselors were 67% male, ranged from age 16 to 68 (median=27 years), 86% white, 45% married (43% single-never married); 55% had been previous rehabilitation closures, 43% were supported primarily by family and friends. All clients had an average of ten years education.

APPLICABILITY: Results of this project should improve services to SCI clients at the HSRC and other comprehensive rehabilitation facilities.

286 The Use of Self-Instructional Training Material with Rehabilitation Personnel (An Evaluation of Vocational Rehabilitation Counselor Functions: A Self Instructional Training Package)

Principal Investigator:	Roy C. Farley, M.S.	
1976		
Status:	New	
Dates:	January, 1975-October, 1976	
Cost:	Annual $7,619 RT Annual $5,257	Projected Total $8,600 RT % of Annual Total 68.9%
Annual Report Reference:	#11, Page 37, R-131	
1977		
Status:	**Continuing**	
Dates:	**January, 1975-February, 1977**	
Cost:	**Annual $11,120** **RT Annual $8,034**	**Projected Total $23,500** **RT % of Annual Total 72.2%**
Annual Report Reference:	**#12, Page 159, R-131**	

OBJECTIVES:

1. To assess the value of **Vocational Rehabilitation Counselor Functions: A Self-Instructional Training Package.**
2. To measure the effectiveness of the package in teaching the intended principles and concepts.
3. To evaluate users' attitudes toward the package.

METHODOLOGY:

1. Three random sample groups will be selected from a population of rehabilitation counselors, rehabilitation counselor students, and non-counseling rehabilitation personnel.
2. A series of tests, based upon counselor functions presented in the training package, will be given to all participants to determine present level of knowledge of the principles and concepts.
3. Participants will be asked to work through each self-instructional manual.
4. The tests will be readministered to determine the extent to which concepts and principles were learned.
5. Participants will be asked to complete an attitudinal evaluation test designed to rate the package on a 5 point scale, ranging from poor to excellent, with mid-point being the minimally acceptable level.

FINDINGS TO DATE: Material for the training package has been completed and printed. Topics covered by the self-instructional manuals are:

1. Rehabilitation Counselor Code of Ethics
2. Developing Referral Sources: Effective Casefinding
3. Structuring the Counselor/client Interaction
4. Basic Principles for Determining Client Eligibility
    a. General Provisions

   b. Evaluation of Rehabilitation Potential
   c. Extended Evaluation for Determining Rehabilitation Potential
   d. SSDI and SSI Cases
5. Case Recording
6. Managing the Flow of Cases
7. Confidentiality of Information

Copies have been disseminated to the various rehabilitation agencies. The research sample groups have been identified and data collection initiated. Assessment devices have been developed and pre-tests administered to the research sample groups. Due to a delay in the printing of the manuals, it has become necessary to extend the project in order to complete data collection and analysis.

APPLICABILITY: With an increasing demand on the rehabilitation counselor's time, the need is apparent for training materials which require little time and are both effective and inexpensive. This package is being developed in response to that need.

287 Development of a Training Manual on Psychological Aspects of Disability

Principal Investigator	Brian Bolton, Ph.D.	
1976		
Status:	New	
Dates:	April, 1975-June, 1977	
Cost:	Annual $15,238 RT Annual $10,514	Projected Total $32,000 RT % of Annual Total 69%
Annual Report Reference:	#11, Page 47, R-133	
1977		
Status:	**Continuing**	
Dates:	**April, 1975-June, 1977**	
Cost:	**Annual $16,680** **RT Annual $12,051**	**Projected Total $35,000** **RT % of Annual Total 72.2%**
Annual Report Reference:	**#12, Page 169, R-133**	

OBJECTIVES: To develop a training manual which outlines the general principles of somatopsychology, the unique aspects of various disabilities, the implications for counseling practice, and various personal adjustment techniques and programs.

METHODOLOGY: The manual will consist of the following units:

1. General Principles of Somatopsychology
2. Unique Considerations – specific disabilities
3. Client-Practitioner Interaction Issues
4. Personal Adjustment Training Programs

Each unit will include:

1. A summary and discussion of research findings
2. Outlines of representative articles and studies and a guide to the literature
3. A list of implications for the practitioner

FINDINGS TO DATE: Outlines of the units comprising the manual have been prepared and chapters are being refined.

APPLICABILITY: The purpose of the manual is to synthesize existing knowledge in a form suitable to the rehabilitation practitioner. If utilized, the knowledge will improve the counselor's ability to work with disabled clients, and ultimately enhance the effectiveness of the rehabilitation process.

288 Development and Evaluation of an Interpersonal Skills Training Package

Principal Investigator: Robert L. Akridge, Ph.D.

1976

Status: New

Dates: February, 1975-February, 1978

Cost: Annual $17,771 Projected Total $18,000

RT Annual $12,615 RT % of Annual Total 71%

Annual Report Reference: #11, Page 67, R-136

1977

Status: Continuing

Dates: February, 1975-February, 1978

Cost: Annual $22,796 Projected Total $46,000

RT Annual $16,469 RT % of Annual Total 72.2%

Annual Report Reference: #12, Page 173, R-136

OBJECTIVES:

Phase I

1. To determine inter-rater reliability of the following measures: a) Counselor Facilitation Scale, b) Client Self-Directive Behavior Scale, c) Client Self-Revealing Scale, and d) Client Internalization/Externalization Scale.
2. To study the relationship between ratings on these measures and client outcome in terms of status at closure.
3. To compare the relationship of the above measures with a comprehensive battery of psychological tests.

Phase II

1. To assess the impact of the IPS training package on client outcome, when used by VR counselors who have been trained by VR agency trainers.
2. To assess the impact of the IPS package on the interpersonal environment of a comprehensive VR center.

METHODOLOGY:

Phase I

1. Tape recorded counselor/client sessions will be rated (tapes already available in data bank).
2. Client closure status, R-300 data and client psychological test sub-scores are also available from the data bank.
3. Correlational analysis and multiple regression analysis will be used to analyze the data.

Phase II

1. Selected state agencies and rehabilitation centers will be asked to participate in the development of a comprehensive field test of the training program.
2. Clients of experimental group counselors (who will receive IPS training) and control group counselors (no IPS training) will be tracked with systematic assessment for a period of at least 2 years.
3. Specific data gathering procedures, instruments, and methods of analysis will be developed through consultation with participating rehabilitation agency personnel.

FINDINGS TO DATE:

1. Editorial and instructional design work on the IPS materials have been completed.
2. Developmental field tests have been conducted.
3. Phase I data collection and analysis have been completed.
4. A "second generation" trainer (trained by an RT-13 trainer) conducted an IPS experiment with nursing students. The experimental group nurses showed significantly higher skill levels on all criteria measures.
5. Plans are being completed to work through regional continuing education programs to conduct an evaluation of the IPS package in terms of whether counselors, trained by second generation trainers, influence client behavior to a comparable degree.

APPLICABILITY: The IPS training program purports to effect an improvement in basic counselor helping skills. With such training, counselors should be expected to achieve superior results in helping clients define and achieve goals and resolve problems.

289 A Comprehensive Evaluation of the Relationship Between Disability and Personality Functioning: Implications for Rehabilitation Counseling

Principal Investigator:	Brian Bolton, Ph.D.	
1976		
Status:	New	
Dates:	September, 1975-December, 1976	
Cost:	Annual $10,051 RT Annual $7,008	Projected Total $14,000 RT % of Annual Total 69.7%
Annual Report Reference:	#11, Page 87, R-139	
1977		
Status:	**Continuing**	
Dates:	**September, 1975-June, 1978**	
Cost:	**Annual $11,120** **RT Annual $8,034**	**Projected Total $30,000** **RT % of Annual Total 72.2%**
Annual Report Reference:	**#12, Page 179, R-139**	

OBJECTIVES:

1. To assess the extent of relationship between disability type and patterns of personality functioning for eleven groups of rehabilitation clients.
2. To review and summarize relevant literature in a series of tabular presentations.
3. To draw implications for rehabilitation counselors of any obtained differences in terms of hypothesized behavioral functioning of rehabilitation clients.
4. To conduct item factor analysis of two of the instruments for purpose of assessing their construct validity with rehabilitation clients.

METHODOLOGY:

1. Sample will consist of approximately 300 rehabilitation clients who participated in a nationwide study of the rehabilitation counseling process.
2. Four instruments were administered to the clients at the time of acceptance for rehabilitation services. The instruments are classified into three areas of personality functioning:
   a. psychopathology,
   b. self-concept, and
   c. normal personality.
3. The major statistical analyses will include:
   a. Comparisons of the eleven disability groups on the subscales of the various instruments. Analyses of variance will be followed by Duncan's Multiple Range Test.
   b. Principle components analyses and Varimax rotations will be used to isolate homogeneous clusters of items which reflect client response patterns on the Tennessee Self-Concept Scale and the 16 PF (Form E). Recent research (Howarth and Browne, 1971) and reviews (Bentler, 1972) have questioned the dimensionality, and thus the validity of the scoring systems, of the 16 PF and the TSC respectively.

FINDINGS TO DATE:

1. Disability of Self-Concept: A Comparative Investigation.

   A nationwide sample of 326 rehabilitation clients representing twelve disability groups completed the Tennessee Self Concept Scale (TSCS) at the time of acceptance for services. Statistical comparisons were made among the twelve groups on 14 selected TSCS scales.

   Conclusions:

a. Disablement has a significant negative impact on self-concept.

b. Individual response to disablement is extremely variable.

c. Some disabilities have a more severe impact on self-esteem than others.

d. The analyses results suggested that many physically disabled clients who report favorable self-concepts may be protecting themselves against an underlying tendency toward serious emotional disturbance.

2. Factorial Validity of the Tennessee Self-Concept Scale.

This investigation was designed to compare the factorial structure of examinees' responses to the Tennessee Self Concept Scale to the rationally derived subscale structure of the instrument. Oblique rotations of four variable sets which represent successive condensations of the TSCS item sample were carried out.

Conclusions:

a. The presence of three positive and three negative items within each of the 15 combinations of content (three perspectives and five selves) does not effectively control for acquiescence responding.

b. The three design facets of the FSCS (direction, perspectives, and selves) clearly interact in defining the dimensions of examinee response to the 90 items.

c. The factorial structure of the examinees' responses to the 90 TSCS items is generally not consistent with the rational design of the instrument.

3. Disability and Psychopathology: A Multitrait-Multimethod Investigation.

This investigation was designed to address three major research questions concerning the relationship between disability and psychopathology.

a. To assess the relative degree of emotional disturbance among 12 disability groups on the standard psychopathology scales of the Mini-Mult and the PSS (an evaluation of the dimensional hypothesis).

Conclusion:

The dimensional hypothesis was supported by the Mini-Mult and PSS comparisons.

b. To assess the relationship between nature of disabling condition and psychopathological classification using statistically generated Mini-Mult profile groups (an evaluation of the typological hypothesis).

Conclusion:

The cross-tabulations of disabling condition by two independently derived Mini-Mult profile cluster schemes did not support the typological hypothesis in the domain of self-reported psychopathological symptomatology.

c. To assess the relationship between clients' views of their psychological adjustment (measured by the Mini-Mult) and the agency's view of the extent of the clients' psychopathology (measured by the PSS) (an evaluation of the perspectives hypothesis).

Conclusion:

The substantial correlations between the Mini-Mult and PSS provided overwhelming support for the perspectives hypothesis in the realm of psychopathological assessment.

4. Psychologist vs. client Perspectives in the Assessment of Psychopathology.

The Minnesota Multiphasic Personality Inventory (MMPI) and the Psychiatric Status Schedule (PSS) were administered to two samples of clients. The MMPI summarized the clients' subjective views of their emotional status while the PSS provided an "objective" assessment from the psychologists' perspectives. Statistical analyses of the resulting multivariable-multimethod matrix revealed a substantial convergence of client and psychologist perspectives; however, the implication of these findings for clinical and counseling practice is that the MMPI (or any of its short forms) should not be used alone in diagnosing the nature and extent of emotional disturbance; some form of structured interview should be employed to provide an additional perspective on the client's self-perceived distress, as well as ascertaining unique information regarding the degree of impairment in other areas of functioning.

APPLICABILITY: The importance of psychological variables in the rehabilitation process has been documented in research as well as the experience of practitioners. This investigation is premised on the assumption that improved understanding of client psychological variables will result in more appropriate and efficient rehabilitation services.

290 The Development of an Improved System for Measuring Client Outcome

Principal Investigator	Paul G. Cooper, M.S.	
1976		
Status	New	
Dates	July, 1975-December, 1977	
Cost	Annual $20,316 RT Annual $14,017	Projected Total $50,000 RT % of Annual Total 69%
Annual Report Reference	#11, Page 95, R-140	
1977		
Status:	**Continuing**	
Dates:	**July, 1975-December, 1977**	
Cost:	**Annual $22,239** **RT Annual $16,067**	**Projected Total $55,000** **RT % of Annual Total 72.2%**
Annual Report Reference:	**#12, Page 191, R-140**	

OBJECTIVES. The proposed study will consider outcome measurement in two settings — a rehabilitation facility and two general VR agencies. The objectives will be accomplished in three priority listed phases.

Phase I will emphasize client gain from acceptance to closure. Measurement will be counselor or agency oriented.

Phase II will investigate client outcome from the clients' point of view using consumer input as a basis for the study. Rehabilitation gain from acceptance to closure will be emphasized.

Phase III will investigate the two dimensions of client outcome at some time after closure in a follow-up study. Outcome measures will be based upon consumer input and agency data.

METHODOLOGY.

Phase I:

a. The sample for the analysis consisting of clients enrolled as students at the HSRC. Using existing records, HSRC staff will supply select information on 100 randomly chosen clients exposed to the two week work evaluation period during 1974. R-300 data will be obtained for these clients permitting an analysis of training outcomes. These data will provide a baseline for comparisons to current experimental evaluation procedures.

Current clients enrolled in work evaluation will provide information comparable to the above baseline data. In addition, the specifically designed instrumentation will be administered to a sample of current clients.

The sample for the general agency portion of the study will consist of vocational rehabilitation clients in Arkansas and Oklahoma. R-300 and Service Outcome Measure (SOM) data are available from Arkansas for FY 1975. Oklahoma is providing R-300 and SOM data for a comparable period.

To meet the objectives of Phase I for the Conway facility the following research methodology will be implemented: three different members of the facility staff will rate each client upon admittance, again after approximately six weeks and finally at discharge using the Arkansas Facility Outcome Measure rating form. All raters simultaneously received approximately three hours of training in the use of the rating form.

From the data collected an estimate of the instrument reliability will be obtained.

b. Instrumentation: For both the facility and general agency portions of this study, existing instruments which may be used include the Mini-Mult, Arkansas Facility Outcome Measure, Arkansas Service Outcome Measure, and the Oklahoma Service Outcome Measure. The R-300 data will be used for comparison purposes.

c. Statistical Methodology: The primary techniques used in the analysis of data collected are presently undetermined and will depend upon the properties of the data collected.

Phase II and Phase III:

SOM and R-300 data will be collected on a routine basis after July 1, 1975 from Arkansas and Oklahoma. Other states in Region VI will be invited to participate in the study. A short vocational adjustment/outlook scale will be developed to parallel the vocational items on the SOM. A follow-up instrument will be identified or developed for assessment of client vocational and personal-social adjustment.

FINDINGS TO DATE:

1. Planning conferences were held with appropriate personnel at the Hot Springs Rehabilitation Center and the Oklahoma Rehabilitation Agency. Both agencies agreed to provide the R-300 and the SOM data on a continuing basis. Negotiations were undertaken with these agencies to allow possible implementation of new instruments within their systems.
2. Rehabilitation Gain Measures for Physical Therapy and Occupational Therapy were revised for use.
3. Data tapes have been received from Arkansas and Oklahoma containing R-300 and Service Outcome data.
4. A study of the reliability of the Facility Outcome Measure has been initiated.
5. Baseline data currently being collected and computerized. Instrumentation has been developed, and selected measures modified to provide information on the dimensions of client outcome (personal-social and vocational adjustment) by point of view (evaluation staff and client) and by time (enrollment to discharge).
6. Approximately 100 Conway Facility clients have been rated using the Facility Outcome Measure. These data have been collected and punched on computer cards. Preliminary analysis has been completed but no projections as to the reliability of the instrument may be made at this time.

APPLICABILITY: Valid measures of client gain will provide insight into effectiveness of rehabilitation programs in general. Analysis of the severely disabled population in the general agencies will provide insight into the effectiveness of rehabilitation of these clients.

291 Evaluation of the RIDAC (Rehabilitation Initial Diagnosis and Assessment for Clients) Project for the Arkansas Rehabilitation Service

Principal Investigator:	Brian Bolton, Ph.D.	
1976		
Status:	New	
Dates:	July, 1975-September, 1978	
Cost:	Annual $12,697 RT Annual $8,760	Projected Total $40,000 RT % Annual Total 69%
Annual Report Reference:	#11, Page 105, R-141	
1977		
Status:	**Continuing**	
Dates:	**July, 1975-September, 1978**	
Cost:	**Annual $13,901** **RT Annual $10,043**	**Projected Total $43,000** **RT % of Annual Total 72.2%**
Annual Report Reference:	**#12, Page 203, R-141**	

OBJECTIVES: Specific objectives of RIDAC Project are:

1. Reduction in time lag between client referral for services and his movement to an active status.
2. Reduction in "08" closures (cases closed from a referral status.)
3. Increased and more readily available documentation of client diagnostic information.
4. Increased number of severely disabled clients accepted for services.

The purpose of this project is to evaluate the success of the RIDAC project in meeting these four objectives.

METHODOLOGY: The RIDAC Project is designed to evaluate 1,200 clients per year. Counselors will refer those clients who meet the criteria for determination of severe disability.

The following data will be collected for each of the RIDAC Project clients: reason for referral to RIDAC (detailed), dates on which the various decisions from referral through acceptance to closure are made, the referring counselor's evaluation of client status at referral and closure using the Client Outcome Measure, standard R-300 information, and a wide variety of medical, psychological, and social information collected in conjunction with the RIDAC evaluation.

The RIDAC Project will be evaluated in terms of the extent to which to specific objectives stated above are met. A comparison group will be selected on a matched basis from rehabilitation clients referred and served by the ARS during previous years.

FINDINGS TO DATE: The RSA grant funding the RIDAC Project was approved and staffing was begun in July, 1975. This following personnel were employed as of October 1, 1975: physician, nurse, project coordinator, psychologist, three vocational evaluators, and two secretaries. A preliminary evaluation battery including the following psychological and vocational tests was in use as of October 15, 1975: WAIS, Draw-A-Person, Bender-Gestalt, GATB, California Preference Survey, VALPAR Work Evaluation System (5 tests), Purdue Pegboard, Work Values Inventory, and 16 PF Questionnaire. Test batteries are individualized for each client as the result of a preliminary meeting between the referring counselor and the Project coordinator. The test scores and recommendations are reported to the counselor at a final case staffing which is held after the prescribed tests have been administered, scored, and interpreted. The RIDAC Project is housed in the Little Rock district office of the ARS.

The evaluation plan for the Arkansas RIDAC unit includes three areas of assessment: (1) impact on clients, (2) usefulness to counselors, and (3) effectiveness of the unit. Each area is briefly summarized below.

1. During the first nine months of operation the RIDAC unit evaluated 439 clients, of whom one half were categorized as severely disabled. Less than 20% of the clients were closed in 08 status and the average number of days between referral to the agency and acceptance or 08 closure was approximately 30 days. Only 520 days were required to complete the typical RIDAC evaluation. The volume of RIDAC services is indicated by the number of evaluations conducted: medical (318), psychological (272), and vocational (203).
2. After more than six months experience using the RIDAC unit, counselor opinions were highly favorable. A need expressed by half a dozen counselors resulted in the addition of a psychiatric consultant to the RIDAC unit.
3. The effectiveness of the RIDAC unit will be assessed by comparing the outcomes for the RIDAC-evaluated clients with a matched sample of clients served during previous years. We elected not to employ an experimental design with random assignment of clients to RIDAC and traditional evaluation after reviewing the results of Houston's Project Expedite (Goldston and Jefley, 1975).

APPLICABILITY: The potential applicability of the results of the RIDAC Project is great. If the RIDAC assessment approach is demonstrated to be effective in improving services to clients, the basic concept should be utilized in other district offices and rehabilitation facilities.

292 Application of Personal Achievement Skills to Personal Adjustment Training for the Blind

Principal Investigator:	**Richard Roessler, Ph.D.**	
1977		
Status:	**New**	
Dates:	**November, 1975-February, 1977**	
Cost:	**Annual $5,560** **RT Annual $4,017**	**Projected Total $8,000** **RT % of Annual Total 72.2%**
Annual Report Reference:	**#12, Page 35, R-144**	

OBJECTIVES

1. To provide Personal Achievement Skills (PAS) training to adjustment personnel working with blind clients.
2. To adapt PAS training materials to blind clients.
3. To conduct an applied field study of PAS in two rehabilitation facilities for the blind – Arkansas Enterprises for the Blind (AEB) and Criss Cole Rehabilitation Center for the Blind (CCRCB).

METHODOLOGY

Phase I – Training of Trainers

Training in the PAS program will be conducted by RT-13 personnel for participating counselors in both facilities.

Phase II – Development of Materials

PAS materials will be converted into a PAS package appropriate for use with blind clients.

Phase III – Completion of Two Field Studies

Consenting clients from the regular rehabilitation programs of both facilities will be randomly assigned to experimental (receiving PAS training) and control (not receiving PAS training) groups. Program outcome data will be collected from client, facility and agency perspectives. Pre and post measures on both client groups will be obtained and compared – i.e., profiles in skill development at the beginning and end of the program, regular rehabilitation outcome data, and R-300 data will be compared.

FINDINGS TO DATE: Limited counselor training has taken place at both facilities. Preliminary PAS materials have been developed, and research efforts are currently underway. Each facility has completed a pilot study based on the experimental/control random assignment design. Reception of the program by both counselors and clients has been positive.

APPLICABILITY: It is anticipated that PAS will provide workers for the blind with an additional tool for involving blind clients in the development of their own rehabilitation program.

293 Development and Evaluation of a Self-Instructional Physical Fitness Training Program for Spinal Cord Injured Rehabilitation Clients

Principal Investigator:	**G. Tim Milligan, MSE**	
1977		
Status:	**New**	
Dates:	**November, 1975-December, 1976**	
Cost:	**Annual $7,783** **RT Annual $5,623**	**Projected Total $9,000** **RT % of Annual Total 72.2%**
Annual Report Reference:	**#12, Page 47, R-145**	

OBJECTIVES: To develop an individualized self-instructional physical fitness training program for use of rehabilitation clients with paraplegic involvement.

METHODOLOGY: Sample will consist of medically stable, spinal cord injured clients enrolled in vocational or pre-vocational training in a large rehabilitation facility.

New enrollees in the SCI recreation/fitness program will be evaluated to determine their physical functioning level. Following the fitness evaluation, clients will be given the self-instructional program to use as their fitness training curriculum. After two months, participating clients will be re-evaluated to determine progress.

Participating SCI clients will evaluate the program on the following criteria:

1. degree of assistance required to perform activities
2. value of the exercise (does it help?)
3. enjoyability of the exercise
4. probability of continued use of the program

FINDINGS TO DATE: Program materials have been developed and are being reviewed by professional SCI rehabilitation personnel. The program is being field tested with a small sample of SCI rehabilitation clients. These clients will be asked to provide input as to the utility of the program and needed modifications.

APPLICABILITY: This program should provide a physical fitness training program to increase the physical functioning level of SCI clients. Hopefully, it will result in a shorter rehabilitation time and decreased incidence of physical losses following termination of formal physical therapy services.

294 Consumer Involvement and Policy Development Consultation: A Resource Manual for Staff Development Personnel and Rehabilitation Trainers

Principal Investigator:	**B. Douglas Rice, Ed.D.**	
1977		
Status:	**New**	
Dates:	**November, 1975-July, 1977**	
Cost:	**Annual $8,326** **RT Annual $6,011**	**Projected Total $14,000** **RT % of Annual Total 72.2%**
Annual Report Reference:	**#12, Page 53, R-146**	

OBJECTIVES:

1. To produce a resource manual in the area of Consumer Involvement for Staff Development Personnel.
2. To develop the material in conjunction with the IRI Manual on Consumer Involvement: Rehabilitation Issues.

METHODOLOGY: A review of the 1973 Rehabilitation Act, 1974 Amendments, and Federal Register will be conducted. References will be cited followed by a discussion of the implications for rehabilitation agencies. The results will be incorporated into a Resource Manual for Staff Development Personnel to be used in training programs. The Project will review legislation, regulations, and guidelines, citing sources, providing interpretations and possible methods of implementation.

FINDINGS TO DATE: Preliminary work for this project has been initiated through the IRI document Consumer Involvement: Rehabilitation Issues. Collection of additional materials is in progress. Some Regional Seminars have been held and the proceedings are now available. A few states have formed Consumer Advisory Committees or established forums to provide state agency input into policy development.

APPLICABILITY: The project is intended to facilitate dissemination of information through in-service training programs by staff development personnel. Consumer Involvement and Policy Development Consultation are critical issues and priority areas in rehabilitation, and will provide Staff Development Officers with a basic resource document for training programs.

295 Rehabilitation of the End-Stage Renal Disease Client — Selected Readings

Principal Investigator:	**Vernon L. Glenn, Ed.D.**	
1977		
Status:	**New**	
Dates:	**November, 1975-June, 1977**	
Cost:	**Annual $5,560** **RT Annual $4,017**	**Projected Total $9,000** **RT % of Annual Total 72.2%**
Annual Report Reference:	**#12, Page 57, R-147**	

OBJECTIVES: To develop a sourcebook or reference book containing selected readings concerning the rehabilitation of the end-stage renal disease.

METHODOLOGY: Information and materials concerning the rehabilitation of the ESRD client will be reviewed and appropriate articles will be selected for inclusion in the document. Authors will be contacted to secure permission to reproduce their writings.

FINDINGS TO DATE: Literature search has been initiated and is still in progress.

APPLICABILITY: With increased emphasis on serving the more severely disabled and the development of numerous ESRD research and demonstration projects, additional information in a concise, readable, convenient consolidation will be of value to practitioner's in understanding the problems of the ESRD client. The ESRD client is a new disability group to meet rehabilitation practitioners, and this project will bring together all the pertinent literature on the subject.

.296 Development and Evaluation of a Training Package in Program Evaluation

Principal Investigator:	**Paul Cooper, M.S.**	
1977		
Status:	**New**	
Dates:	**November, 1975-September, 1977**	
Cost:	**Annual $25,019**	**Projected Total $50,000**
	RT Annual $18,075	**RT % of Annual Total 72.2%**
Annual Report Reference:	**#12, Page 61, R-148**	

OBJECTIVES: To develop a primary sourcebook of relevant evaluation strategies, three independent self-instructional modules, and three instruments designed to measure skill and knowledge gain as a result of training with the package modules.

METHODOLOGY:

1. Content Development – Basic theory presented in standard textbooks and journals, program evaluation studies and research efforts conducted by state agencies and R&T Centers will be illustrated and applied directly to program evaluation problems in vocational rehabilitation.
2. Evaluation – The package will be field tested, using a group of program evaluators from Region III. First, the trainers will be randomly divided into two treatment groups. One group will receive training through self-instruction and the other group will receive training through an instructor conducted seminar. The second factor will be the repeated measure pre-post factor to determine skill and knowledge gain due to training.

FINDINGS TO DATE:

1. Compilation and review of a considerable amount of program evaluation literature has been accomplished.
2. A bibliography of literature related to survey techniques has been compiled.
3. Basic textbook sources have been identified.
4. Content development for this module is underway.

APPLICABILITY: The project is designed to develop materials to improve the skills necessary for state program evaluators to effectively meet the Federal requirements for program evaluation.

297 Developing a Model for the Analysis of Case Movement in a Vocational Rehabilitation System

Principal Investigator: Paul Cooper, M.S.
1977
Status: New
Dates: September, 1975-December, 1977
Cost: Annual $11,120 Projected Total $25,000
RT Annual $8,034 RT % of Annual Total 72.2%
Annual Report Reference: #12, Page 69, R-149

OBJECTIVES:

1. To identify standard models which might be applicable to case movement in a rehabilitation agency, and to identify data needed to construct the model.
2. To implement data collection procedures in two ARS district offices and conduct an informal evaluation of these procedures.
3. Based on the data collected, to construct a case movement model and test its validity.
4. To modify and refine the model for use in other state rehabilitation agencies.

METHODOLOGY: Statistical literature dealing with stochastic processes (the study of the flow of events in the time) queueing theory (the study of waiting lines), and operations research will be searched for appropriate statistical models. Should this search indicate a simulation model to be more appropriate, a GPSS (General Purpose Systems Simulation) program will be written to simulate case movement in a rehabilitation agency. After the model is developed, testing and refinement will be an on-going process. Predictions of numbers of cases in various statuses and average stays in various statuses will be made and verified by observing the actual outcome. The model may then be refined and the process will continue.

FINDINGS TO DATE: Objective #1 has been completed. It was determined that standard branching processes models were not feasible, and a simulation approach will be attempted.

Data collection procedures have been finalized and initial evaluation of data collection procedures and data reliability is in process.

Complete data have been collected on approximately 200 clients.

APPLICABILITY: The development of a valid case movement model for rehabilitation agencies could provide better understanding of case movement, more accurate prediction of future demand on facilities under alternative intervening situation, and better evaluation of changes in the system. Thus such a model is useful in both the planning and evaluation of rehabilitation programs.

298 Development and Evaluation of a Set of Systematic Training Units to Increase or Decrease Selected Client Behaviors — (Behavior Skills Training)

Principal Investigator: Robert L. Akridge, Ed.D.
1977
Status: New
Dates: March, 1976-February, 1978
Cost: Annual $27,799 Projected Total $56,000
RT Annual $20,084 RT % of Annual Total 72 %
Annual Report Reference: #12, Page 77, R-150

OBJECTIVES: To develop, evaluate, and disseminate a set of training units designed for counselors to use to increase client goal behaviors, or to decrease client problem behaviors.

METHODOLOGY: Needs Assessment – ARR&TC faculty members will rate counselor/client taped interviews on the basis of behavioral dimensions and their frequency of occurrence. A survey of most common client problems encountered will be conducted among practicing rehabilitation counselors. Priorities for the development of various training units will be assigned on the basis of results from the above two activities.

Development – Once the target behaviors are identified, professional literature will be examined for existing programs which could be modified or strengthened to increase or decrease a particular behavior. Once the training units have been developed, they will be tested with rehabilitation clients, revised and retested until treatment consistently produces the desired level of post training performance.

FINDINGS TO DATE:

1. Completed development of a comprehensive model of the adjustment process in the form of a matrix. (Each Behavioral Skills Training Unit will refer to a particular cell of this matrix).
2. Refined the information processing model of behavior and developed instruments to test hypotheses deduced from the model.
3. Instruments developed for determining which clients need what kind of behavioral skills training and how to measure progress. Reliability and validity studies of these instruments are presently being made.

APPLICABILITY: This project has the potential for making substantive additions to the rehabilitation counselor's repertoire of skills for helping clients change undesirable behavior. The most obvious applications are in the context of group counseling or client adjustment training where clients are already a part of a cohesive group.

299 Rehabilitation Counseling: Development and Evaluation of a Comprehensive Counseling and Case Management Model

Principal Investigator: **Stanford Rubin, Ed.D.**
1977
Status: **New**
Dates: **March, 1976-February, 1981**
Cost: **Annual $105,680** **Projected Total $525,000**
RT Annual $76,349 **RT % of Annual Total 72.2%**
Annual Report Reference: **#12, Page 89, R-15**

OBJECTIVES:

1. To identify effective rehabilitation counselor interview behavior.
2. To identify effective rehabilitation counseling non-interview actions.
3. To develop a case management handbook for rehabilitation counselors.
4. To prepare a series of training modules for teaching the skills identified in 1 and 2 above.
5. To develop instruments to assess the extent of counselor trainee skill acquisition.
6. To develop, disseminate, and evaluate self-instructional packages to train counselors to rate and classify counselor/client interaction.
7. To evaluate the completed training programs.
8. To revise and prepare a final training program based on results from the initial evaluations.
9. To prepare research reports on the effectiveness of the training programs.
10. To continue the refinement of the Facilitative Management Model of Rehabilitation Counseling through research.

METHODOLOGY: This project will be a coordinated effort involving several Center faculty. The methods to be used are similar for each of the four major components of the model: interaction techniques, information exchange effectiveness, goal setting/goal attainment and facilitative actions. Individual components are as follows:

Interaction Techniques.

Case Management Handbook,
Counseling Process Scales Training,
Information Exchange Effectiveness,
Goal Setting Goal Attainment, and
Facilitative Action.

The general research methodology is as follows:

a. Development of Training Modules

The training modules will be developed to increase the trainees' awareness of different counselor skills and the effects they have on client behavior. Guidelines for the facilitative use of counselor skills will be presented. The training modules will include:

1. A didactic component which will be presented via lecture and modeling and will include:
   - a. Definition of training module
   - b. Rationale for the training module
   - c. Listing and definition of various counselor skills
   - d. A listing of the principles for the effective use of each skill
2. A discrimination component designed to train counselors to discriminate between effective and ineffective skills. This will be done via modeling, role-playing, and listening to and critiqueing tapes.
3. An experiential component designed so that trainees will be provided the opportunity to practice the counselor skills via role-playing exercises.

b. Development of Assessment Devices

The following areas will be assessed:

1. Cognitive Gain: Tests will be developed to measure trainee comprehension of the concepts and principles presented in the training modules.
2. Skills Gain: The degree to which the trainees learn the skills advocated in the training modules will be determined via direct observation of their capability to emit the desired behaviors. Necessary rating scales will be developed.
3. Attitudinal Evaluation: An evaluation form will be developed to measure the trainee's satisfaction with the provided training.

c. Assessment of the Training Modules

In order to determine the effect of training, the following will be performed:

1. A random sample of rehabilitation counselors will be drawn and divided into an experimental (training) and control (no-training) group.
2. Knowledge of appropriate behavior and ability to emit such knowledge will be assessed prior to training.
3. The experimental group will receive the Facilitative Case Management Training.
4. The control group will receive no training.
5. Following completion of training the counselor trainees will be assessed to determine if any cognitive or behavioral development has occurred. Also the attitudinal evaluation described above will be administered to the experimental group.

FINDINGS TO DATE: Developmental work has been initiated on all four training areas in this project.

APPLICABILITY: The rehabilitation counselor remains as the principal client representative of the vocational rehabilitation system. However, the optimal counselor role model for serving the severely handicapped has not been adequately defined. The Facilitative Case Management model based on an integration of counseling and case management skills provides a reality oriented approach for rehabilitation counselors which has the potential to maximize the counselors' positive impact on clients.

300 Systematic Psychosocial Vocational Treatment Strategies in Vocational Rehabilitation Settings Serving the Severely Handicapped

Principal Investigator: **Robert Akridge, Ed.D.**

1977

Status: **New**

Dates: **March, 1976-February, 1981**

Cost: **Annual $119,690** **Projected Total $600,000**
RT Annual $86,362 **RT % of Annual Total 72.2%**

Annual Report Reference: **#12, Page 105, R-152**

OBJECTIVES:

1. To identify psychosocial-vocational problems experienced by the severely disabled
2. To clarify aspects of the problem requiring remediation: e.g., person, antecedent, or consequence variables
3. To select an appropriate mode and method of psychosocial-vocational treatment
4. To develop psychosocial-vocational treatment strategies to problems in living experienced by the severely disabled
5. To evaluate the psychosocial and vocational gains resulting from treatment
6. To develop methods for maintaining treatment gains in the client's real life setting

METHODOLOGY: The systematic psychosocial-vocational treatment project is a coordinated effort involving several center faculty. The objectives and methodology of the component research projects vary depending upon the topic for investigation. Research topics are as follows: Client Motivation in Rehabilitation, Counselor and Client Viewpoints on Rehabilitation Issues, Client Perceptions of the Service Delivery Systems of a Comprehensive Rehabilitation Center, Development of a Rehabilitation Psychosocial Model, Development and Evaluation of an "Understanding Human Behavior" Training package.

The general research methodology for each of these investigations is presented below:

Client Motivation in Rehabilitation. This investigation will include the following activities: a) review of the experimental and theoretical literature pertaining to client motivation; b) preliminary analyses of objective test data, including several motivational variables; c) a programmatic investigation of the motivational dynamics of rehabilitation clients in selected field offices and facilities; d) preparation of an instructional manual for rehabilitation counselors entitled "Understanding Unmotivated Clients."

A preliminary review of the literature indicates that there are several variables or specific measures relevant to this investigation: self-concept or self-esteem, as measured by the Tennessee Self-Concept Scale or Coopersmith Inventory; internal-external locus of control; need for achievement, as measured by TAT Protocols; level of aspiration; and Cattell's Motivational Analysis Test. After completing selected analyses, a comprehensive battery of tests and measures will be selected for use in the programmatic investigation of motivation. The design will include counselor assessment of client demographic and psychological variables relevant to motivation. Experimental studies will be conducted to supplement the primary multivariate-correlational investigation.

Counselor and Client Viewpoints on Rehabilitation Issues. Recent research (Leviton, 1973) suggests that success and failure in rehabilitation may be a function of counselor/client agreement (or disagreement) on seven philosophical issues: a) client participation versus emotional neutrality; 3) hopeful versus realistic approaches; 4) preferential treatment for promising patients versus equal consideration for all; 5) promoting independence versus allowing some independence; 6) safety versus some risk-taking; and 7) full disclosure of an invisible handicap versus hiding it whenever possible.

This project seeks to 1) develop self-report measures for each of the seven issues and assemble normative data for counselors and clients; 2) examine the relationships among counselor and client value positions on viewpoints and various counselor and client characteristics; and 3) examine the relationship between the extent of counselor/client agreement on the seven issues and other aspects of the counseling relationship including measures of rehabilitation success. Instrument development will proceed following the standard recommended steps. Collection of normative data and conduct of research to meet the second and third objectives will involve various district offices of the Arkansas Rehabilitation Services.

Client Perceptions of the Service Delivery Systems of a Comprehensive Rehabilitation Center. This investigation will be conducted to identify problems that rehabilitation clients face in a comprehensive rehabilitation facility; to chart changes in the psychosocial development levels of clients during their facility tenure; to measure client perceptions of the facility's environment and client satisfaction with facility experiences in their facility programs will be conducted at the Hot Springs Rehabilitation center.

In response to the four principal objectives of the project, data will be gathered from rehabilitation clients on the following instruments: Analysis of Behavioral Competence, Psychosocial Development Matrix, Moos' Community Oriented Programs and Environment Scale, and a Client Satisfaction Service Rating Measure. Data pertinent to the objectives of the study will be collected from clients at different stages of tenure in the center. The longitudinal cross-sectional design provides estimates of the changes on key variables which occur over time at the center.

After the identification of student problems, the second phase of the study involves presentation of the data in terms of management implications for possible changes in center programming. The third phase of the study calls for a second administration of the Behavioral Competence, Psychosocial Development, Social Climate, and Client Satisfaction measures to assess the effects of changes in center policy and practice.

Development of a Rehabilitation Psychosocial Model. This investigation will be conducted to 1) develop a functional rehabilitation psychosocial treatment model; 2) identify the stages of psychosocial growth; 3) identify skills and supporting knowledge rehabilitation workers need to facilitate client movement through the psychosocial growth process; 4) identify existing and needed programs and techniques which facilitate the psychosocial growth process; and 5) identify methods of evaluating the psychosocial growth process.

The ARR&TC has had an active history in the development of psychosocial techniques for rehabilitation. Previous research, as well as ongoing studies, provides the basis for this comprehensive model.

Psychosocial Treatment Procedures in a Rehabilitation Field Office. This project will be conducted to: 1) develop an overall psychosocial treatment strategy in rehabilitation field offices; 2) publish the strategy in terms of guidelines appropriate for any field office serving non-rural populations; 3) develop procedures whereby Personal Achievement Skills training can be provided as an ongoing aspect of the field office services; 4) integrate and coordinate the client's psychosocial growth resulting from Personal Achievement Skills training and Behavior Analysis Training with the counselor's efforts; 5) integrate RT-13 psychosocial treatment strategies such as Behavioral Skills Training, Handbook of Behavioral Management, etc., into individual and group approaches to psychosocial treatment; 6) identify other resources which might contribute to the effectiveness of field office programs in meeting client psychosocial needs; and 7) evaluate the training programs' effects on client outcome and staff behavior.

In testing this approach in a field office, the initial step will be to win the staff's acceptance of and support for development of a model program of psychosocial adjustment in their field office setting. Throughout the development of the program, the staff would be continually involved in defining and evaluating the effects and feasibility of program modifications.

The first innovation will be that of initiating the Personal Achievement Skills program for all feasible clients served by an office. Counselors will then be instructed in the use of Behavior Analysis Training and other selected techniques for individual interaction with clients. An approach to case staffing drawing on insights from the psychosocial treatment program will also be tested. As the basic concept of coordinated individual and group psychosocial services is implemented, other existing programs and techniques will be reviewed by the staff for possible inclusion in the program. Throughout the process, pre and post assessment of clients processed through the office will be completed. Staff attitudes will also be monitored. Guidelines for implementing this model will be developed and disseminated in a report containing research findings related to direct client outcomes and staff reactions.

Development and Evaluation of an "Understanding Human Behavior" Training Package. This investigation will be conducted to develop 1) a method for analyzing client behavior; 2) a method for viewing maladaptive behavior which suggests intervention strategies; 3) a method for viewing the process of movement from maladaptive to adaptive behavior patterns which suggests appropriate methods of interaction; 4) a method for viewing maladaptive behavior in terms of skill deficits; and 5) a method for conceptualizing the interaction between the person and prevailing systems. The resulting material will be integrated into an effective training program to be utilized by rehabilitation trainers. Evaluations of the effects of the training will be conducted. Based on the training experiences, existing materials of the Arkansas Rehabilitation Research and Training Center will be further developed and modified. The revised materials will be tested on seven groups of rehabilitation personnel, and feedback from these groups will serve as a basis for modification of the training program.

Development and Evaluation of a Program to Utilize Clients as Peer-Helpers in a Comprehensive Rehabilitation Center. This investigation will be conducted to 1) develop a training program to increase the interpersonal effectiveness of student leaders in a comprehensive rehabilitation center; 2) provide the training to selected student leaders in a comprehensive rehabilitation center to enable them to serve as effective helpers; and 3) evaluate the effectiveness of the training. The effectiveness of the training will be evaluated by measuring trainee improvement on a measure of facilitation, comparing the behavioral problems of the student before and after training, measuring student satisfaction with the help received from peer leaders, and training facility staff to conduct the training should they so desire.

Behavior Analysis Training: A Developmental Program. The foundation for Behavior Analysis Training can be found in the current Personal Achievement Skills training program conducted by the Arkansas Rehabilitation Research and Training Center. The experiences that have been gained in Personal Achievement Skills training have already been applied to the development of the central ideas of Behavior Analysis Training.

With the development of a preliminary set of materials for Behavior Analysis Training, personal adjustment counselors at the Hot Springs Rehabilitation Center and elsewhere will pilot test the materials with several clients. Based on feedback from field tests a revised version of the training package will be developed.

FINDINGS TO DATE: This project is a major effort in the psychosocial area and mostly developmental work has been completed to date.

APPLICABILITY: This project holds considerable promise for the resolution of major adjustment problems in rehabilitation. Activities include studies of problem identification, treatment programs for problem behaviors, and increasing life-adjustment/life-planning skills.

301 Program Evaluation Techniques in Vocational Rehabilitation Agencies and Facilities

Principal Investigator:	**Reed Greenwood, Ed.D.**	
1977		
Status:	**New**	
Dates:	**March, 1976-February, 1981**	
Cost:	**Annual $56,154** **RT Annual $40,570**	**Projected Total $95,000** **RT % of Annual Total 72.2%**
Annual Report Reference:	**#12, Page 123, R-153**	

OBJECTIVES:

1. The identification and/or development of outcome technology.
2. The utilization of outcome technology.
3. The identification and/or development of process technology.
4. The utilization of process technology.

METHODOLOGY: The methodology used in this project may be classified into five types of activities.

1. Identification: This research technique includes literature reviews and searches for appropriate measures and methods.
2. Development: This activity includes the development of needed instrumentation and technology.
3. Adaptation: This activity includes the adaptation and implementation of evaluation measures to specific situations such as center training efforts or individual rehabilitation facilities.
4. Utilization: This activity may include the utilization of outcome and process technology in an evaluation or field study setting.
5. Analysis: This activity includes the statistical analysis and interpretation of data collected as part of the project as well as the estimation of instrument parameters such as norms or reliability.

FINDINGS TO DATE: The current year's activities include the following:

1. Work on a Center position paper for the program evaluation core area.
2. Identification and review of literature sources of outcome and process measurement technology.
3. Preparation of two journal articles.

4. Two presentations at the 1976 National Conference of the National Rehabilitation Association:
   Cook, Daniel. "Assessing Client Satisfaction with Rehabilitation Services."
   Cooper, Paul. "The Measurement of Rehabilitation Service Outcome."
5. Consultation with Arkansas Rehabilitation Services concerning the design of a case review sampling procedure.

APPLICABILITY: This project is planned to focus initial effort on the continuing assessment of rehabilitation outcome along relevant dimensions compatible with the objectives of rehabilitation agencies and projects, the prediction of case flow within the rehabilitation system, the assessment of client gain realized through psychosocial-vocational adjustment programs, and the measurement of the effects of rehabilitation counseling.

302 The Identification of Factors Affecting Behavioral Competency in a Comprehensive Rehabilitation Center

Principal Investigator: **John Marr, Ph.D.**
1977
Status: **New**
Dates: **August, 1976-August, 1977**
Cost: **Annual $6,951** **Projected Total $30,000**
RT Annual $5,022 **RT % of Annual Total 72.2%**
Annual Report Reference: **#12, Page 135, R-154**

OBJECTIVES

1. To identify problems in each service area of the rehabilitation facility.
2. To identify factors which restrict staff in their attempts to cope with the problems.
3. To analyze the problems and factors in terms of relative importance and possibility of resolution.
4. Prepare reports for facility administrators on recommendations and strategies for resolving the behavioral problems.

METHODOLOGY: All sections (except maintenance) of the facility staff will be surveyed in an effort to determine a) the extent to which each service facilitates effective operation of the Center, and b) extent to which each service contributes to the final objective of the center — preparing the client for employment.

A survey will also be made of a) a sample of field counselors who have referred clients to the Center, to determine their objectives for service delivery when referral was made, and b) field counselors with recently graduated or terminated clients, to determine their satisfaction with the Center's delivery of services.

Analysis procedures will be developed following identification of various types of data collected.

FINDINGS TO DATE: Specific research instruments have been developed or identified. Necessary planning sessions have been held with the HSRC administrator. Interviews and data collection are scheduled to begin in October, 1976.

APPLICABILITY: This project is viewed as an applied, action research study to determine factors which affect the efficiency and effectiveness of a comprehensive rehabilitation facility. The possibilities for generalization will be limited by the uniqueness of the facility to some extent. However, the results should have some application to similar facilities.

303 Increasing Research Utilization Through the Development of Training Packages

Principal Investigator: **Selected Consultants**
1977
Status: **New**
Dates: **August, 1976-October, 1977**

Cost:	**Annual***	**Projected Total $20,000**
	RT Annual *	**RT % of Annual Total ***
Annual Report Reference:	**#12, Page 143, R-155**	

*Financial data currently undetermined.

OBJECTIVES:

1. To utilize consultants in the field of Instructional Media Design to assist R&T Center facilty in transforming knowledge and understanding gained from rehabilitation research into training packages for utilization of rehabilitation personnel.
2. To print, publish, and disseminate training materials to rehabilitation agencies throughout the United States.

METHODOLOGY: The development of these training packages will be a coordinated effort involving several R&T Center faculty already involved in this type of project. Funds requested in this proposal will be utilized to employ professionals on a consultant basis who are trained in the field of Instructional Media Design. When the materials have been developed they will be printed and disseminated to rehabilitation trainers on a national basis.

FINDINGS TO DATE: Three training packages have been developed in the past year by ARR&TC and others are now being initiated.

APPLICABILITY: This project is directly related to all rehabilitation agencies, as the packages and materials will be developed from rehabilitation research and designed for utilization and implementation by rehabilitation agencies.

University of West Virginia (RT-15)
Vocational Rehabilitation Research and Training Center

CORE AREAS

Program Evaluation

Techniques and strategies to improve the capacity of vocational rehabilitation in program assessment and evaluation, and data management and utilization to increase the effectiveness of the rehabilitation program in meeting the needs of those it serves.

Improved Service Models

Investigating various aspects of the vocational rehabilitation system with the aim of providing information and models which will permit rehabilitation to increase the effectiveness of its services and service delivery system.

Programmatic Barriers to Vocational Rehabilitation

Identification and assessment of all types of program barriers to vocational rehabilitation at all levels, e.g., state, national, leading toward a data base for policy development and promulgation.

Affirmative Action and Consumer Involvement

Strategies and techniques for enabling vocational rehabilitation and handicapped individuals for maximizing the impact of legislation leading toward total integration of handicapped into the world of work.

Institute on Rehabilitation Issues

Technical support to the IRI in the study of significant issues of current concern to the rehabilitation community.

UNIVERSITY OF WEST VIRGINIA

Joseph B. Moriarty, Ph.D., Director
University of West Virginia Vocational
Rehabilitation Research and Training Center
Institute, West Virginia 25112

PROJECT TITLES BY FY 1977 status

COMPLETED

Abstract No.

Enhancing the Responsiveness of the Rehabilitation Service Delivery System to the Needs of the Severely Disabled (Richard T. Walls, Ph.D.) 304

Factors Associated with Successful Rehabilitation of Handicapped Individuals of Various Disability Categories (Richard T. Walls, Ph.D.) 305

Family Unit as an Untapped Rehabilitation Force (Ranjit Majumder, Ph.D.) 306

R-300: A Vocational Rehabilitation Profile (A Model for Assessing How Vocational Rehabilitation Programs Function) (M. S. Tseng, Ed.D.) 307

Systematic Analysis of Rehabilitation Data for Program Evaluation (former title: R-300 Study) (Ranjit K. Majumder, Ph.D.) 308

Effects of Vocational Evaluation on Vocational Rehabilitation (M. S. Tseng, Ed.D.) 309

Program Evaluation – Modular Information System to Evaluate Rehabilitation (Ranjit K. Majumder, Ph.D.) 310

CONTINUING

Program Evaluation and Planning (Tools for Rehabilitation) (Richard T. Walls, Ph.D.) 311

Towards a Placement System Empirically Established Through Criterion-Group Method: Self-Employment for the Severely Handicapped (M. S. Tseng, Ed.D.) 312

Simplified Model for Cost-Benefit Analysis in Rehabilitation Programs (Ranjit K. Majumder, Ph.D.) 313

NEW

Analyzing Performance Competencies of Severely Handicapped Clients (Richard T. Walls, Ph.D.) 314

Negative Incentives: Contingencies which Discourage Disabled Individuals from Seeking or Completing Rehabilitation Services and Subsequent Employment (Richard T. Walls, Ph.D.) 315

Development of a Valid Multiple-Factor Instrument to Assess Severity of Handicap (Joseph B. Moriarty, Ph.D.) 316

PROPOSED

Factors Influencing Work Adjustment of Disabled Workers (M.S. Tseng, Ed.D.)

304 Enhancing the Responsiveness of the Rehabilitation Service Delivery System to the Needs of the Severely Disabled

Principal Investigator: Richard T. Walls, Ph.D.
FY 1976
Status: Completed
Dates: January, 1969-January, 1976
Cost: Annual $6,500 Projected Total $25,000
RT Annual $5,980 RT % of Annual Total 92%
Annual Report Reference: #10, Page 17, R-13

OBJECTIVES: The objectives of this study were to conduct a series of small-scale demonstration projects in a variety of VR settings in order to assess the feasibility of adopting learning and behavior change principles as a basis for improved rehabilitation programming.

METHODOLOGY: We have involved subjects in these substudies ranging across the broad range of clients and potential clients. Severely handicapped clients with mental retardation, emotional, and behavioral disability have been the primary target groups, but clients with orthopedic and other handicaps have also been involved.

The variables have been (a) contingent and non-contingent, (b) immediate and delayed, (c) gain and loss of (d) various reinforcing stimuli for (e) variable performances of (f) work related and on the job tasks.

We have utilized rating scales, behavior checklists, direct observation, self recording, and machine monitoring. Each has its place and purpose depending upon the behaviors, clients, and objectives of study or therapy.

FINDINGS TO DATE: Due to the brief space, summaries of only the first and last year of the project are provided here.

1968 Studies of individual and group applications of behavior change techniques to rehabilitation were summarized. In addition, my work at the West Virginia Rehabilitation Center was reported in part. Two case studies with supporting data were used to illustrate. Client 1 became one of the hardest working, most dependable clients in prevocational training. Client 2 markedly improved his scores for spontaneous and elicited speech in speech therapy. The two cases cited were clients who would have probably either dropped from training voluntarily or been terminated for "lack of motivation" to perform and lack of confidence in their own ability to succeed. Thus, two inexpensive contingencies were directly instrumental in changing the behavior of adult clients. Rehabilitation recording and simple reinforcement contingencies as illustrated by the preceding review and behavioral examples.

1975 Do mentally deficient adults react to right as a satisfier and wrong as an annoyer? Is there an affective difference as differentiated from knowledge of results as corrective cues? The findings reported here support an affirmative answer to these questions. Although the information function of knowledge of results has been well documented, the affective products of such feedback have been relatively neglected. In the present investigation thirty mentally retarded adults guessed one of two routes at each of eleven choice points of a multiple T maze. Following visual and verbal feedback, the subject's GSR was monitored in a five-second post-feedback period. As hypothesized, greater psychophysiological affect was associated with "right" feedback than with "wrong." This effect persisted across blocks of trials. Further support of such findings have implications for management and supervision of sheltered and competitive employment.

APPLICABILITY: Such work has tremendous potential for developing improved strategies of service to the severely disabled client. Use may be made of the findings to restructure contingencies in competitive and sheltered employment.

A properly responsive environment for the VR client is this work's relevance to rehabilitation. That environment is more than simply reinforcing desired behaviors and ignoring or punishing undesired ones. It considers such questions as appropriateness of the reinforcing stimuli to the setting, the behavior and the client. It considers schedules of reinforcement related to antecedent conditions and discriminative stimuli for change.

305 Factors Associated with Successful Rehabilitation of Handicapped Individuals of Various Disability Categories

Principal Investigator: Richard T. Walls, Ph.D.

FY 1976

Status: Completed

Dates: May, 1972-January, 1976

Cost: Annual $8,875 — Projected Total $20,000

RT Annual $7,935 — RT % of Annual Total 90%

Annual Report Reference: #10, Page 62, R-22

OBJECTIVES: The purpose of the present investigation was to identify possible relations between location and identification of the alcoholic and his/her progress toward vocational rehabilitation. Other similar studies in this project have involved (a) mild, moderate, and severe mental retardation, and (b) psychotic-neurotic disability groups.

METHODOLOGY: The subjects for this study were all the alcoholic referrals to the VR agency for the fiscal year 1970-71 in the United States. There were 33,196 such individuals. Some of these 33,196 referrals were accepted for VR services and some were not accepted for services. For example, an individual may apply to or be referred to the VR agency by letter, by telephone, by direct contact, or by any other means. This person is a referral once the agency records his name, address, reported disability, age, sex, date of referral, source of referral, and social security number. He moves to Applicant Status when he says he would like to work with VR and signs the application. Sometimes extended evaluation (up to 18 months) is necessary to determine eligibility for services. If the client is not eligible for rehabilitation services, or eligibility cannot be determined, the case is closed in Status "08", meaning that he is not accepted for VR services.

If however, he is accepted for services, he becomes a client and will exit classified as "26" (closed rehabilitated), "28" (closed unsuccessful after rehabilitation plan initiated), or "30" (closed unsuccessful before rehabilitation plan initiated). To illustrate, suppose client A is eligible for VR services. A rehabilitation plan is prepared for him and is approved. For some reason (for example, moving away) this case may have to be closed at this point before services are actually initiated. If this is done, he is closed in Status 30. It is more likely that he will move on to receive counseling, physical restoration service, and /or training. After these services, if the client is closed unemployed he is classified in Status 28; if the client is closed employed, he is classified in Status 26.

FINDINGS TO DATE:

Question 1: What sources refer alcoholics most likely to be accepted for VR services?

"7. Other Chronic Hospitals or Sanitoriums" yield a higher than average acceptance rate (78%), as do "13. Other Public Health Organization" and "14. Other Private Health Organization" (80% and 78%), while "15. Public Welfare" yields a lower than average acceptance rate (50%), as does "17. SSDDU" (Social Security Disability Determination Unit) with 30%, and "20. State Employment Service" with 50% acceptance rate.

Question 2: What sources refer "alcoholics" most likely to be rehabilitated? Again, only Referral Sources with more than 200 clients that differ by 10% or more from the mean are discussed.

"6. Mental Hospitals" yielded higher than average rehabilitation rates for all of their referrals (49%) as well as for those accepted (68%), as did "29. Physicians" (46%; 68%). "13. Other Public Health Organization" and "14. Other Private Health Organization" showed higher than average rates of rehabilitation referrals (52% and 53%); however, only the Private Health Organization showed a higher than average rehabilitation rate of those accepted (67%).

"8. General Hospital" and "15. Public Welfare" yielded both lower than average rehabilitation rates for all of their referrals (25% and 21%) as well as for those accepted (44% and 42%).

"17. SSDDU" and "20. State Employment Service" yielded lower than average rehabilitation rates for all their alcoholic referrals (15% and 29%).

Question 3: How may these findings be combined, and what do they mean in terms of program, policy, or practice changes? By combining these two sets of results, the following summary findings are derived. In those statements, + indicated above the mean percent, while – indicated below the mean percent.

"7. Other Chronic Hospitals or Sanatoriums", "13. Other Public Health Organizations", and "14. Other Private Health Organizations" refer alcoholics who are accepted by VR at a higher than average rate (+ 12%, + 14%, and + 12% respectively); further, they are good prospects for rehabilitation (+ 5%, + 7%, and + 10% respectively). "15. Public Welfare", "17. SSDDU" and "20. State Employment Service" refer alcoholics who are accepted by VR at a lower than average acceptance rate (–16%, –36%, and –16% respectively). And while those referred from "15. Public Welfare" and "17. SSDDU" are poor prospects for rehabilitation (–15%, and –9%), VR is apparently successful in screening "20. State Employment Service," applicants since they have an average prospect for rehabilitation (+1%).

Although "6. Mental Hospitals" and "29. Physicians" refer alcoholics who are accepted by VR at only a slightly higher than average rate (+7% and +3%), those accepted are good prospects for rehabilitation (+11% and +11%). "8. General Hospitals" refer alcoholics who are accepted by VR at a slightly lower than average rate (−9%), and those accepted are poor prospects for rehabilitation (−13%).

APPLICABILITY: Results similar to those reported herin may help states to codify selection priorities as recently mandated (Public Law 93-112, 1973). Many have suggested that priority of selection (when states are not able to serve all) would naturally be based on disability classification.

Such findings are also of help to VR in policy and program, screening and evaluation. Use might be made by advising or training the referral personnel. For example, if SSDDU staff are advised of the fact and reasons that only 15% of their referrals are eventually rehabilitated by VR, their selectivity may increase. Increased selectivity by such referral sources would reduce duplication of effort and evaluation costs.

VR provides each referring agency with materials to guide their referrals. However, some referring individuals have little knowledge of suitable clientele or the purpose and operation of VR. Feedback about acceptances and rehabilitations to referring agencies should aid in sensitizing them to the quality of their referrals. Further, it appears that the data presented here are a strong mandate for VR to communicate more completely with individuals and agencies who make the referrals.

306 Family Unit as an Untapped Rehabilitation Force

Principal Investigator:	Ranjit Majumder, Ph.D.	
FY 1976		
Status:	Continuing	
Dates:	January, 1972-April, 1976	
Cost:	Annual $21,733 RT Annual $19,559	Projected Total $25,000 RT % of Annual Total 90%
Annual Report Reference:	#10, Page 44, R-21	
FY 1977		
Status:	**Completed**	
Dates:	**January 1972-December 1976**	
Cost:	**Annual $21,733** **RT Annual $19,559**	**Projected Total $60,000** **RT % of Annual Total 90%**
Annual Report Reference:	**#11, Page 18, R-21**	

OBJECTIVES: The purpose of this study was to identify the salient family parameters, either structural or functional that may have a bearing on rehabilitation process and outcome. Specific objectives were:

1. To measure the degree of congruence (agreement) between unsuccessfully rehabilitated clients and one significant member of their family and between successfully rehabilitated clients and one significant member of their family.
2. To measure the degree of difference in congruence between the unsuccessfully and the successfully rehabilitated client groups.
3. To determine factors and perceptions contributing to discussion of disability-related problems and conflict arising from these problems.

METHODOLOGY:

1. The study sample consisted of a stratified sample of 106 Vocational Rehabilitation clients and their families. Stratification covered six different categories of disabilities and two types of rehabilitation, including 65 "unsuccessful closures" (11, closed in status 28, "after receiving services;" and 54, closed in status 30, "before receiving services" and 41 "successful closures" (all closed in status 26). Of the 106 clients, 49 were male and 57, female. The average age was 42.6 (standard deviation, 16) and the average educational level was 10.4 years (standard deviation 3.6).
2. The primary dependent variables in the study were: demographic factors, family factors, impact of disability on: family relationships, marital relationships, relationships outside of the family, getting a job, participation in recreational activities, unusual dependency, need for special attention, getting around inside the house, and getting around outside the house; participation in sports,

clubs and organizations, hobbies, and church; and agreement on need for medical treatment, specialized education, psychological services, and better employment, housing, food, and clothing. The independent variables were (1) successful and (2) unsuccessful rehabilitation, as well as differential responses of client and family member on selected variables.

A structured comprehensive interview schedule was developed and administered via personal interview for both clients and their significant family member. The questionnaire included demographic variables and 30 items concerning perceptions of the impact of disability and its effects on family, work, recreation, and mobility. Items were presented on a five-point scale, with "1" being "no problem" and "5" being "very serious."

3. Additional questions were asked regarding frequency of discussion of problems, frequency of mutual agreement on solutions to problems, frequency of frustration and/or anger as a result of discussing problems.
4. Analysis of the data included the use of the chi-square in evaluating family congruence and 17 analyses of variance performed in a two by four format for each of the dependent measures in evaluating discussion of disability related problems and conflict arising from these problems.

FINDINGS TO DATE: In the portion of this study concerning client-family congruence the results indicate that family members and clients tend to hold the same opinions regardless of successful or unsuccessful rehabilitation. Three major areas of perception were examined: impact of disability, participation in social and leisure time activities, and rehabilitation services. Under impact of disability there was disagreement between client and significant family member in only two out of nine areas examined, need for special attention and getting around outside the house, with disagreement in both cases being in the unsuccessfully rehabilitated group. Concerning participation in social and leisure time activities, disagreement was seen in only one out of four areas examined, hobbies, with unsuccessfully rehabilitated clients disagreeing with their significant family members on frequency of participation. The largest and most frequent disagreement between rehabilitation clients and their significant family members occurred in the area of rehabilitation services. In two out of five areas examined, the unsuccessfully rehabilitated clients expressed disagreement with their significant family members. Family members felt that the need for specialized education was greater than did the unsuccessfully rehabilitated clients and the clients felt the need for psychological services to be greater than did their family members. There was no statistically significant disagreement in any area examined between successfully rehabilitated clients and their significant family members. An additional finding of this portion of the study showed that while there was general agreement in nearly all areas between both successfully and unsuccessfully rehabilitated clients and their significant family members, in the unsuccessful group this congruence tended to be in the direction of more negative perceptions.

In the portion of this study concerning factors and perceptions contributing to discussion of disability related problems and conflict arising from these problems, 17 independent classification variables were examined. The most pervasive finding was that clients report more discussion of problems and more mutual agreement than their significant family members report.

APPLICABILITY: The results of this study indicate that one major factor which may dramatically affect the success of a client's rehabilitation is the family. Since a high measure of congruence between clients and their significant family members was found in nearly all areas examined, counselors can assume that a client's perceptions of his or her disability, whether positive or negative, will be shared by other members of the client's family. Obviously, the client's family will be a strong reinforcer to client attitudes. If these attitudes or perceptions are positive (as was indicated in the successfully rehabilitated group) direct involvement of the family in the client's rehabilitation process could be a decided assistance to successful rehabilitation.

If, on the contrary, these attitudes or perceptions are more negatively directed, it would seem imperative that counselors involve the total family on the rehabilitation process, since, as this study shows, such client perceptions are a crucial indicator of an inter-familial pattern of negativism which could adversely affect rehabilitation outcome.

The portion of this study concerning client discussion of disability related problems and possible resultant family conflict provides similar applications. Again, the importance of a total family intervention approach is emphasized. The results indicate that the client's attempts to discuss and communicate problems within the family environment, and beliefs that these attempts are successful are not perceived by the significant family members. This apparent disagreement may indicate that the nature of the interaction required for full family support in the rehabilitation process exceeds the communication skill repertoire of the family. Recognition of the nature and effects of family members' perceptions and behaviors should enable the counselor to structure the rehabilitation process in a manner to aid the client in reducing familial frictions that lessen efforts toward the rehabilitation objective.

307 R-300: A Vocational Rehabilitation Profile (A Model for Assessing How Vocational Rehabilitation Programs Function)

Principal Investigator:	M.S. Tseng, Ed.D.	
FY 1976		
Status:	Continuing	
Dates:	March, 1973-January, 1977	
Cost:	Annual $26,250 RT Annual $24,150	Projected Total $70,000 RT % of Annual Total 90%
Annual Report Reference:	#10, Page 124, R-25	
FY 1977		
Status:	**Completed**	
Dates:	**March 1973-January 1977**	
Cost:	**Annual $13,657** **RT Annual $12,564**	**Projected Total $70,000** **RT % of Annual Total 90%**
Annual Report Reference:	**#11, Page 83, R-25**	

OBJECTIVES:

1. To generate a vocational rehabilitation profile from the R-300 data which shows at least in part the baseline characteristics of clients at various stages of rehabilitation.
2. To test a number of hypothesized relationships among variables on the R-300 Form.
3. To compare different types and groups of clients on variables tapped by the R-300 Form.
4. To provide vocational rehabilitation personnel with a computerized system of computing and plotting standardized measures (normalized stanine scores) of certain ordinal variables on the R-300 Form.

METHODOLOGY:

1. A total of 44,911 R-300 forms processed by the West Virginia Division of Vocational Rehabilitation from 1968 to 1971 constitute the population. Of these cases, 5% of the 1968-69 data, 10% of the 1969-70 data, and 100% of the 1970-71 data are analyzed.
2. A total of 62 variables, including 20 ordinal variables (10 intake, 8 process, 2 outcome variables) and 42 nominal variables (20 intake, 16 process, and 6 outcome variables), on the R-300 Form are involved.
3. The measuring instrument is the Form R-300 Case Service Report (Federal-State Program of Vocational Rehabilitation).
4. Strictly empirical criteria are used for achieving, both descriptively and inferentially, a data-based presentation of vocational rehabilitation profiles. The probability level of .05 is used as the cut-off point for determining significant correlations and for testing null hypotheses.
5. Computer programming is accomplished through the use of FORTRAN.

FINDINGS TO DATE:

1. A computer program STANINE (written in FORTRAN) is functional for converting raw scores into normalized stanine scores. STANINE is designed to be used by users who have a minimum of computer skills. It produces 2 tables for each variable. The first table lists every value of the variable, frequency of its occurrence in the data set, and, among other things, the stanine score for that value. The second table shows the upper and lower limits of each Stanine score (i.e., showing an interval of raw scores each stanine score actually represents).
2. Another computer program PATPLOT, when given raw data on a normative unit (i.e., client, counselor, etc.), finds the stanine value corresponding to each raw score and plots a 10-variable stanine profile for that normative unit or subject. The output of PATPLOT consists of (a) a page heading including the subject's name, (b) a 10-variable stanine plot with the stanine values on the Y axis and the 10 variables along the X axis with X's plotted at appropriate intersections, (c) the variable names, just below the plot, defining the horizontal points on the X axis, and (d) the corresponding raw score values for that subject appearing directly below the variable names.

APPLICABILITY: Data reduction and analyses carried out by this project yielded not only a quantitative profile of the vocational rehabilitation program but also certain associative and inferential findings that can be used for data-based planning and decision making in vocational rehabilitation by all personnel at various levels. A special note should be made that a computerized system developed by this project can be used to facilitate profile analyses for whatever purposes.

308 Systematic Analysis of Rehabilitation Data for Program Evaluation

Principal Investigator:	Ranjit K. Majumder, Ph.D.	
FY 1976		
Status:	Continuing	
Dates:	March, 1973-April, 1977	
Cost:	Annual $15,956 RT Annual $14,375	Projected Total $60,000 RT % of Annual Total 90%
Annual Report Reference:	#10, Page 169, R-26	
FY 1977		
Status:	**Completed**	
Dates:	**March 1973-January 1977**	
Cost:	**Annual $14,053** **RT Annual $12,928**	**Projected Total $60,000** **RT % of Annual Total 90%**
Annual Report Reference:	**#11, Page 107, R-26**	

OBJECTIVES: The major objective of this study during 1976 was to incorporate, interpret, and synthesize research findings involving R-300 data from three separate projects conducted over a three-year period (R-24, R-25, and R-26). The specific objectives of this project as incorporated from the three separate projects were: (a) to explore the feasibility of constructing and validating predictive models relating intake and process variables to outcome variables, all of which are retrievable from the R-300 form; to generate a vocational rehabilitation profile which shows, at least in part, the baseline characteristics of clients at various stages of rehabilitation; (c) to test a number of hypothesized relationships among variables on the R-300 form; (d) to compare different types and groups of clients on variables tapped by the R-300 form; (e) to provide a model for analyzing selected data elements contained in the Secretary's standards; (f) to demonstrate how univariately analyzed program statistics can be combined to form a "picture" of certain aspects of program operation.

METHODOLOGY: Four populations have been involved in this project:

Fiscal year 1971 — National Data — Approx. 750,000 clients.
FY 1971 — WV Data — 14,569 clients.
FY 1970 — WV Data — 13,887 clients.
FY 1969 — WV Data — 16,455 clients.

A total of 62 variables, including 20 ordinal variables and 42 nominal variables on the R-300 Form were involved in this study. Independent and dependent variables were defined as appropriate to the particular analysis in question.

The measuring instrument utilized was the Form R-300 case service report: Federal-State Program of Vocational Rehabilitation.

Strictly empirical criteria were used for the purpose of achieving data-based presentation of vocational rehabilitation profiles, descriptively and inferentially.

Essentially, the methodology of this project, during 1976, involved the compilation of data from three separate projects conducted over a three-year period (R-24, R-25, and R-26) and a synthesis of these into one interpretive project report.

FINDINGS TO DATE: The accomplishments of this project at completion were:

1. The development of a computer program for analyzing R-300 data as required by the Secretary's General Standards.
2. The compilation of information on how to compute R-300 data as required by the standards and on how to conduct evaluations for data not available on the R-300.
3. The development of the Profile Analysis Technique (PAT) for comparing different R-300 variables.
4. The development of a counselor profile as an alternative to weighted closures.
5. The development of a computer program for normalized stanine, to be used with the Profile Analysis Technique.
6. The development of a computer program for plotting stanines (patplot).
7. The use of a 5% sample in the evaluation of state data.
8. The development of several models for analyzing R-300 data so that portions of it might be used as predictors of rehabilitation outcome.

APPLICABILITY: Since this project integrated three other projects which have been conducted over a three-year period, there are numerous applications from the interpretation of the data which have relevance to individuals involved in vocational rehabilitation at all levels. The broad applications of the findings listed above are as follows:

1. Numerous training materials have been developed out of interpretation and integration of this data and these are available for dissemination. Some of these training materials include: "Understanding the Standards" (a training manual containing information on the Secretary's Standards and instructional materials on the Profile Analysis Technique); a guide for supervisors and others who need a conceptual understanding of the standards and associated performance levels; and a film showing concepts of Profile Analysis Technique and covering its usefulness for comparative purposes.
2. The development of the Profile Analysis Technique (PAT) for comparing different R-300 variables has formed the basis for in-service training materials for evaluators in Region III and is now being used for training in other regions.
3. The use of the counselor profile as an alternative to weighted closure is currently being field tested in West Virginia.
4. The computer programs for normalized stanine and for plotting stanines (patplot) are now available for use by states with computer capability for program evaluation.
5. Some specific questions answered by the R-300 data in accordance with the models for analysis developed by this project have large implications for rehabilitation counselors and supervisors. Examples of these questions include: Is training effective in increasing client income?; Do some client groups appear to need less training?; and Which clients are receiving training?

309 Effects of Vocational Evaluation on Vocational Rehabilitation

Principal Investigator:	M.S. Tseng, Ed.D.	
FY 1976		
Status:	Continuing	
Dates:	March, 1973-March, 1978	
Cost:	Annual $23,142 RT Annual $21,275	Projected Total $46,000 RT % of Annual Total 90%
Annual Report Reference:	#10,Page 194, R-27	

FY 1977		
Dates:	**March 1973-September 1976**	
Status:	**Completed**	
Cost:	**Annual $13,657** **RT Annual $12,564**	**Projected Total $46,000** **RT % of Annual Total 90%**
Annual Report Reference:	**#11, Page 153, R-27**	

OBJECTIVES: To assess the effects of vocational evaluation (with or without work sample) upon a number of immediate and intermediate criteria of the vocational rehabilitation process.

METHODOLOGY:

1. Three groups of approximately 100 clients at The West Virginia Rehabilitation Center are the subjects. Individuals in the first group are exposed to orientation, interview, psychological testing, physical capacities evaluation, work evaluation, job tryouts, and vocational training. Individuals in the second group have all the above experiences except work sample evaluation. Individuals in the third group receive no vocational evaluation at the Center and enter directly into vocational training.
2. All clients are pretested, posttested (only the first and second groups) and retested on social interest, self-significance, attitude toward work, attitude toward friends, self-acceptance, self-estimate of trainability (pretest and posttest only,) training area preference, inter-external locus of control, motive to approach success, motive to avoid failure, work personality, work proficiency, and training satisfaction.
3. Paper-and-pencil instruments are used to measure 55 variables from which the empirical assessment is made of the effect of the vocational evaluation program on vocational rehabilitation.
4. Both descriptive and inferential statistics are used for data analyses.

FINDINGS TO DATE:

1. When the impact of vocational evaluation is assessed by comparing the three client groups in terms of the pretest-retest gain scores (pretest being given shortly after subject's arrival in the Center and retest being administered at the end of vocational training), these variables are found to be significant: (a) motive to avoid failure, (b) attitude toward training (the third item of the trainability self-assessment scale), (c) preference for typist/clerk occupation, (d) preference for landscaping/greenhouse type job, (e) preference for the plumbing trade, (f) preference for radio-TV repair training, and (g) preference for sheet metal work.
2. Group 3 (training only) subjects show significant reduction in their fear of failure when compared to those in the other two groups.
3. Group 1 (vocational evaluation with work sample) subjects, as compared to those in the other two groups), become more sensitive to the notion that not completing vocational training would be a loss to them (i.e., they become more positive about completing the training).
4. While subjects in Group 1 (vocational evaluation with work sample), become more interested in greenhouse and landscape work as compared to those in Group 3 (training only), subjects in Group 2 (vocational evaluation without work sample) become more interested in typing (than those in Group 3), plumbing (than those in Groups 1 and 3), radio-TV repair (than those in Groups 1 and 3), and sheet metal work (than those in Groups 1 and 3).
5. When the three groups of subjects are compared on work personality, work proficiency, and training satisfaction on the basis of posttest-retest gain scores (posttest being administered at the beginning of vocational training and retest being given at the end of training), the variable work personality as rated by the trainer (shop instructor) is found to be significant. Group 1 (vocational evaluation with work sample) and Group 3 (training only) subjects gain higher ratings on work personality during the training period as compared to Group 2 (vocational evaluation without work sample) subjects.

APPLICABILITY: Vocational evaluation is an integral part of the total vocational rehabilitation system. How vocational evaluation contributes to the overall process of rehabilitation is of special interest to VR personnel. The findings of this study would be of special interest to the vocational evaluation staff.

310 Program Evaluation – Modular Information System to Evaluate Rehabilitation

Principal Investigator:	Ranjit K. Majumder, Ph.D.	
FY 1976		
Status:	Continuing	
Dates:	April, 1974-April, 1977	
Cost:	Annual $17,500	Projected Total $80,000
	RT Annual $16,100	RT % of Annual Total 92%
Annual Report Reference:	#10, Page 258, R-30	

FY 1977		
Status:	**Completed**	
Dates:	**April 1974-December 1976**	
Cost:	**Annual $17,500**	**Projected Total $80,000**
	RT Annual $16,100	**RT % of Annual Total 92%**
Annual Report Reference:	**#11, Page 187, R-30**	

OBJECTIVES: The general objective of this study was to develop a model information system for vocational rehabilitation that would collect information about clients and their progress through the rehabilitation process in sufficient and appropriate detail to meet current and anticipated requirements for reporting, including reports on manpower, detailed costs, follow-up, and the capability for analyses, to determine the impact of VR on its clients. The specific objectives were:

1. Identify which items are needed for effective program evaluation and reporting requirements compliance.
2. Design forms and procedures for collecting these items with minimum disruption and duplication of effort.
3. Design a model for storing and processing these items, that is flexible yet comprehensive.
4. Design reports that are useful for program evaluation and meet reporting requirements,

incorporating analyses as desired, as well as summaries.
5. Produce training materials to develop an in-house capability for self-evaluation.

METHODOLOGY: The population sample in this study was taken from test data from the Research and Training Center's copy of the 1970-71 national RSA-300 computer tapes. The use of dependent and independent variables is not applicable to this study. Evaluation will be accomplished by determining if the model is sufficiently useful, as stated by those involved and state agency personnel, to justify the costs of incorporating the desired sections into their own system.

FINDINGS TO DATE: The following findings and accomplishments in this study during 1976 are as follows:

1. A follow-up questionnaire to one sent to state VR agencies in 1975, indicates that one-third of the VR agencies that were then using computers are moving closer toward computerized processing of client data. There seem to be trends toward: more use of statistical analyses, more on-line information retrieval systems, and more reliance on non-VR agency computer professionals, except for data entry.
2. The R&T Center acquired a CRT-based intelligent terminal, impact printer, and purchased programs for direct recording of data into computer readable form, for performing most verification at data entry by the terminal, and for performing some accounting functions automatically. The terminal is used for data entry and validation.
3. The items that are necessary to produce the RSA-300, client data list, and caseload reports were identified. The data entry forms in *(MISTER) collect these data for incorporation into a central file of client data. Reports that are useful for program evaluation and that meet reporting requirements, incorporating analyses and summaries as desired, have been designed.
4. Training materials for the clerical staff of a rehabilitation agency have been developed, in addition to training materials for an in-house capability for self-evaluation.

*the Modular Information System to Evaluate Rehabilitation

APPLICABILITY: The answer for data storage, retrieval and reporting needs in the form of distributed data entry, using intelligent terminals in the field for data collection and data transmission to a central computer for master file maintenance and report production has direct application to state VR agencies as they attempt to comply with the Secretary's Standards for program evaluation of July, 1974. Through this system, agencies would have a better knowledge of how well the rehabilitation process goals are being achieved and agencies would be able to react to changing client mixtures, priorities, and other factors more quickly than is now possible.

A system of "forms" that has been prepared would allow the clerical staff of a rehabilitation agency to perform the basic functions in data entry. In addition, a documentation manual that has been developed includes all the data entry forms, the training forms, the master file record layout, the update record layout, and a chart explaining when each form is used, is available for state agency application.

If it becomes necessary to record more data about a client in order to expand the system, additional forms can be created. New reports can be generated with the same report writing system that has been in use. MISTER is sufficiently modular, and therefore flexible, to accommodate many changes in the file maintenance and reporting needs of a VR agency.

311 Program Evaluation and Planning (Tools for Rehabilitation)

Principal Investigator:	Richard T. Walls, Ph.D.	
FY 1976		
Status:	Continuing	
Dates:	March, 1973-January, 1977	
Cost:	Annual $26,278 RT Annual $24,011	Projected Total $68,000 RT % of Annual Total 91%
Annual Report Reference:	#10, Page 91, R-24	
FY 1977		
Status:	**Continuing**	
Dates:	**March, 1973 — January, 1979**	
Cost:	**Annual $17,298**	**Projected Total $89,730**

RT Annual $16,172 **RT% of Annual Total 92%**

Annual Report Reference: **#11, Page 57, R-24**

OBJECTIVES: To develop a model for evaluation of rehabilitation services. (The research activity is attempting to show the extent to which coded R-300 data may be used to evaluate rehabilitation services.)

The major question is (a) what data elements or variables, (b) what data collection aids, and (c) what data reduction or display techniques will be of greatest value to VR agencies?

METHODOLOGY:

1. The project is examining the records of over 700,000 rehabilitation clients with all types of handicaps.
2. Various variables (demographic, educational, social, economic, disability, process, closure, cost-benefit, outcome, client rated) are being studied.
3. The variables are measured by means of the RSA-300 field counselor's standard report form.
4. Various portions of the project are using analysis of variance, chi square correlation, multiple regression and common sense.
5. A mark-sensing form is being developed that may be machine read that includes all R-300 variables as well as other helpful program evaluation data.
6. The Profile Analysis Technique is being further developed and field tested at National, State, District, and Counselor levels.

FINDINGS TO DATE: R-300 data taken from every client (N = 14,569) was classified into data on 30 intake (or input) variables, 24 process (or intervention) variables, and 8 outcome (or output) variables. In order to identify meaningful relationships and interactions among variables across intake, process and outcome a bivariate and multivariate analysis of the R-300 data was conducted for the purpose of making certain references as well as determining the existing state of affairs in the rehabilitation process.

Intercorrelations among such variables as cost and time, cost and age, cost and earnings at closure, months from acceptance to successful closure, weekly earnings at closure and public assistance amount at closure, etc. were made. Norms on client characteristics enabling a counselor to see how their individual clients resemble at intake persons with similar major disabilities or referral sources and what the processes and outcomes can be expected were established.

Among more interesting findings to date are: 1) spending more time and money on a client is related to better outcome at closure in terms of earnings; 2) the longer a client is in status (referral states) 00-02 (applicant states) the less money will ultimately be spent on him; 3) clients with higher income at intake tend to have more money spent on them. Other similar findings are listed in the Progress Report.

a. During this year we worked with IBM representatives to mock up the Rehabilitation Reporting Record. Galley proofs were made, checked, and returned. A major portion of this time for the project staff involved checking all codes against RSA-300 codes to insure compatibility. Coordination with the Pittsburgh division of IBM led to composition meetings with staff of the IBM paper documents division in Greencastle, Indiana. After two revisions of galley proofs, 1000 copies of the prototype of the form were produced. In addition, the West Virginia Research and Training Center project and production staff worked together to produce a prototype manual (description, instructions, and supplementary codes).

b. Any variety of different variables might be represented on the Caseload Profile. For example, an agency might wish their counselors to have feedback on how many months their clients are staying in statuses 00-02 or how many dollars were spent on physical restoration compared to the state average. Several states are currently using some form of PAT.

APPLICABILITY:

c. The Rehabilitation Reporting Record has the potential to significantly affect rehabilitation policy on a state or national scale. Policies will not be advocated by the project team. The Rehabilitation Reporting Record is clearly not a RSA form. However, widespread exposure to these data elements and format may stimulate shifts in thinking and behavior when standards for program evaluation are proposed and when RSA or state requirements for data are reviewed or revised.

The Caseload Profile employs a device termed the profile analysis technique (PAT). There are five major guiding criteria in the development of this PAT mechanism. These were (a) orientation toward rehabilitation, (b) multiple criteria analysis, (c) flexibility, (d) simplicity in computation, and (e) ease of interpretation. The essential idea is that information routinely collected by state agencies may be used to compare an agency's, district's or individual's performance in a number of categories against a norm (e.g., national, state, or district average).

312 Towards A Placement System Empirically Established Through Criterion-Group Method: Self-Employment for the Severely Handicapped

Principal Investigator:	M.S. Tseng, Ed.D.	
FY 1976		
Status:	Continuing	
Dates:	January, 1974-July, 1977	
Cost:	Annual $18,286	Projected Total $55,000
	RT Annual $16,675	RT % of Annual Total 90%
Annual Report Reference:	#10, Page 230, R-29	
FY 1977		
Status:	**Continuing**	
Dates:	**January 1974-July 1977**	
Cost:	**Annual $8,534**	**Projected Total $55,000**
	RT Annual $7,851	**RT % of Annual Total 90%**
Annual Report Reference:	**#11, Page 175, R-29**	

OBJECTIVES:

1. To sort out (using guidelines for the Self Employment Program, WVa Division of Vocational Rehabilitation Manual), through the criterion-group method, from a list of personal attributes, those which would characterize severely disabled persons who are successful in self-employment settings;
2. to determine the personal characteristics profile of the clients at the time of placing them in self-employment projects; and
3. to validate this placement system by following up these clients for a reasonably long enough period of time.

METHODOLOGY:

1. Two sample groups are examined. The first sample consists of successfully and unsuccessfully self-employed former vocational rehabilitation clients. The second sample consists of clients who are being closed in Status 26 as the self-employed cases.
2. Forty personal attributes (including intelligence, attitudes, and various personality factors) are measured in all of the clients. Paper-and-pencil questionnaires (SBE, SEP), the Revised Beta Examination, the arithmetic section of the Wide Range Achievement Test, and the Sixteen Personality Factor Questionnaire Form C are administered to tap these variables.
3. Inferential statistics, including analyses of variance and Chi square analyses, and descriptive statistics, such as correlation and discriminant analysis, are carried out.

FINDINGS TO DATE:

1. Sample 1 data (33 successful and 20 unsuccessful cases) show that out of 40 personal attributes, 11 differentiate the successfully self-employed group from the unsuccessful group.
2. Of the 11 variables, these 9 yield metric data: self-acceptance, attitude toward work, perception of success, need for autonomy, attitude toward self-sufficiency, desire for profit, desire to be one's own boss, conservative-experimenting personality, and uncontrolled-controlled personality. A statistically significant discriminant equation has been formulated using these 9 client variables as predictors. This discriminant equation is capable of achieving 85.7% hit on the prediction of successfully self-employed clients.
3. To acquire Sample 2 data, clients who are being placed in the self-employment settings are given Questionnaire SEP. Up to this point data of 24 such clients have been taken. Cross-validation analyses will be carried out when more cases are included in Sample 2, their abilities to function as self-employed individuals monitored, and the outcomes of their self-employment status known after a reasonably long enough period of time.

APPLICABILITY: This project provides those rehabilitation counselors, who are in the position to help severely disabled clients, with empirical data useful for carrying out job placement and job development activities, especially with respect to self-employment.

313 Simplified Model for Cost-Benefit Analysis in Rehabilitation Programs

Principal Investigator:	Ranjit K. Majumder, Ph.D.	
FY 1976		
Status:	Continuing	
Dates:	April, 1974-December, 1976	
Cost:	Annual $14,946	Projected Total $25,000
	RT Annual $11,694	RT % of Annual Total 78%
Annual Report Reference:	#10, Page 275, R-32	
FY 1977		
Status:	**Continuing**	
Dates:	**April 1974-May 1977**	
Cost:	**Annual $11,728**	**Projected Total $25,000**
	RT Annual $9,844	**RT % of Annual Total 78%**
Annual Report Reference:	**#11, Page 199, R-32**	

OBJECTIVES: The major objectives of this study are as follows:

1. To develop, apply, and test a procedure of benefit-cost analysis (economic gain or loss) to society from the VR program.
2. To develop a series of cross classified expected benefit-cost ratios through a procedure which predicts both the benefit and the cost stream (life-long benefits that accrue through intervention) from the characteristics of the rehabilitation potential (human capital) and other economic influences.
3. To check the accuracy of the predicted ratios against a second set of benefit-cost ratios developed from the actual earnings and cost experience of the sample of rehabilitants.
4. To suggest the appropriate data base and analyses strategies for VR agencies.

METHODOLOGY: Rehabilitation clients who were accepted in fiscal year 1971 in West Virginia (n=7,515) compose the population from which the study sample was drawn. The bulk of the data to be used in this study comes from the RSA-300 forms, the Case Service Reports of the Federal-State Program of Vocational Rehabilitation, containing a very complete record of the individual from date of acceptance to date of closure. Data on actual earnings was obtained from the WV State Income Tax Records. Since the VR process is being viewed as an investment in human capital, the size of the benefit stream can be expected to be influenced by such factors as the natural abilities of the client, the extent to which the disability affects the maximization of an individual's level of human capital, the number of disabilities and their severity, and various economic conditions to the individual.

A cross-classified analysis will be made, also, involving these variables which are expected to have some differential effect: sex, age, education, location, and disability. In this study, a regression model was developed in which change in the earnings of the rehabilitant was the dependent variable and the above set of factors were included in the independent variables.

FINDINGS TO DATE: Results, during 1976, are for the overall program only. The results for the cross-classified population will be analyzed during 1977. The following findings and accomplishments are reported:

1. The results suggest that the VR program (in this instance) proves to be effective, from a benefit-cost analysis perspective.
2. The tax data applied to the overall results suggest that benefits are durable for at least four years.
3. The tax data also suggests that projections from the RSA-300 data are only slightly optimistic.
4. In addition to developing and testing of the general B/C ratio model, a Simplified Computational Worksheet with detailed instructions was prepared.

APPLICABILITY: The proposed model has the following applications to rehabilitation:

1. The proposed model should provide rehabilitation with a useful tool to check the efficiency and effectiveness of their program efforts. The prepared Simplified Computational Worksheet could possibly be utilized by VR program evaluators.
2. Unlike many other studies, this study uses actual follow-up data from the income tax records,

and it uses the benefit-cost ratio method as opposed to net benefit or the rate of return approach. This method is a more suitable and applicable measure for a program like VR where the total benefit of the program is measured against each dollar spent.

3. The economic proof of effectiveness of this model should provide rehabilitation with concrete evidence to support their need for adequate funding and should place rehabilitation in a good competitive position for such funds.
4. If found to be of reasonable accuracy, the procedure offers an inexpensive and easy-to-apply evaluation procedure to administrators in the VR system.

314 Analyzing Performance Competencies of Severely Handicapped Clients

Principal Investigator:	**Richard T. Walls, Ph.D.**	
FY 1977		
Status:	**New**	
Dates:	**May 1976-May 1979**	
Cost:	**Annual $11,722** **RT Annual $10,960**	**Projected Total $25,000** **RT % of Annual Total 92%**
Annual Report Reference:	**#11, Page 227, R-33**	

OBJECTIVES: There is a substantial number of vocational behavior checklists available and in use today throughout vocational settings. All of these propose target vocational skills for clients.

The major question is which of these skills are actually needed for adequate job functioning? What skills facilitate job entry and job retention? Of all the separate skills (approximately 500) listed in checklists, which ones should be stressed in training, and which ones could be eliminated?

METHODOLOGY: The project team is presently in the process of constructing and refining the vocational skills matrix. As presently projected, it will list behaviors or competencies in 8 areas: (a) Job Related Skills, (b) On-the-Job Social Skills, (c) Union-Financial-Security Skills, (d) Interview Skills, (e) Job Seeking Skills, (f) Specific Job Skills, (g) Prevocational Skills, and (h) Work Performance Skills.

When this work is completed and the necessary liaison work has been done, a small number of clients will be selected from a rural and an urban general case load (to provide generalizability of findings). The training supervisors of these clients will indicate which skills they believe to be necessary for job acquisition and retention in that occupation. The client will be assessed at the end of training to determine which skills are present. Prior to placement in trial employment (if possible) the prospective employer of these clients will indicate which skills they believe necessary for job acquisition and retention in that occupation. Within a week of placement in trial employment, the client will be assessed to determine which skills are present. Finally, the client will again be assessed at the end of the 60 day trial employment period. An indication will also be obtained from the employer as to whether the client will be continued or not and the reasons for that decision.

FINDINGS TO DATE: From the literature review of 157 behavior checklists, 39 were found to contain items (behavior descriptions) related to prevocational, vocational, occupational, and work behaviors. These 39 were reviewed, categorized, and evaluated.

Vocational items from each of 39 checklists were counted and sorted into these eight subclasses.

The project team is currently constructing the matrix for the experiment by eliminating duplicates and overlap in the items. Only vocational items from checklists with objectivity scores of 3, 4, or 5 are being included in the client-training supervisor-employer experimental matrix of skills.

APPLICABILITY: Results of the experiment and training based on the experiment should be of greatest benefit to training supervisors and VR counselors. The ultimate benefactor is the client. Comprehensive vocational skills assessment can help all parties to effective placement. Behavioral statements of skills are not as likely to be misinterpreted as scores on traits, constructs, rating scales, or global objectives.

Further, the findings of this project may be utilized by vocational rehabilitation personnel who must observe, evaluate, and improve client performance. Since vocational rehabilitation services address themselves to a wide variety of client activities, this project will provide a useful function in organizing available performance checklists in terms of activities relevant to getting and keeping a job.

315 Negative Incentives: Contingencies which Discourage Disabled Individuals from Seeking or Completing Rehabilitation Services and Subsequent Employment

Principal Investigator:	**Richard T. Walls, Ph.D.**	
FY 1977		
Status:	**New**	
Dates:	**May 1976-May 1979**	
Cost:	**Annual $10,812** **RT Annual $10,108**	**Projected Total $42,000** **RT % of Annual Total 92%**
Annual Report Reference:	**#11, Page 246, R-34**	

OBJECTIVES: The major question is which types and amounts of cash and in-kind benefits (at what benefit-loss rate) discourage eligible individuals from engaging in and completing VR services. Further, to what extent is this a problem in VR, and, if it is a substantial problem, what are some possible remediating actions?

METHODOLOGY: Subjects. The subjects will be approximately 600 VR clients of varying age, sex, and disabling condition. Of these 600 clients, half will be receiving some kinds of cash and/or in-kind benefits at referral to VR. The other 300 will not be receiving benefits from any of the sources listed at referral.

Design. The design is a simple two group format. The 300 clients receiving benefits at referral will be considered the experimental group and the 300 clients not receiving benefits at referral will be considered the contrast or control group. The independent variable is, thus, benefits at referral versus no benefits at referral. Obviously, the amounts and types of benefits will vary markedly within the experimental group since no attempt to stratify the random sampling procedure will be attempted. This implies blocking on different patterns or clusters of disability, sex, age, or, most importantly, type and amount of benefits will probably aid in clarifying the findings. However, the major result will consist of a comparison of frequencies of successful closures for the experimental versus control group. Thus, the dependent variable is the closure status of the individuals. Factors associated with closure such as competitive employment, homemaker employment, earnings, etc. will also be considered. Chi Square analyses, simple frequencies or percentage tables would be appropriate ways of examining the data.

FINDINGS TO DATE: As noted previously, VR does have some information to serve as a reference (VR status 26) point. Presumably, some similar data could be reported for nonrehabilitated clients (VR status 28 or status 30), but at this writing, to our knowledge no such summaries of national VR data exist.

Further, the data are in aggregate form and may not be used for cross comparisons between VR outcome and total benefits on a casewise basis. While these amounts represent cash benefits per program, they are not instructive as to the total cash benefits that any client may be receiving. Further, they in no way take into account in-kind benefits.

Thus, we have a few gross tallies, percentages, and amounts for overall programs and categories. But the information currently available is woefully inadequate for a careful examination of disincentives that are in opposition to VR philosophy and services.

APPLICABILITY: Theoretically, findings from the study would be of significant social importance. A critical problem facing our legislators today is the establishment of effective governmental assistance programs. A great deal of pressure exists to establish a financial aid system which is helpful and yet equitable. If the findings from this study prove to be of significance, they should guide those who need more than intuition to construct this legislation.

Present policies of financial aid serve as environmental contingencies which serve to influence the actions of those who receive benefits. If the present set of contingencies which exist support behavior which is detrimental in the long run to either the individual or the assisting agencies in question, it is important to change them.

316 Development of a Valid Multiple-Factor Instrument to Assess Severity of Handicap

Principal Investigator: **Joseph B. Moriarty, Ph.D.**

FY 1977

Status:	**New**	
Dates:	**October 1976 -December 1977**	
Cost:	**Annual $54,998** **RT Annual $49,999**	**Projected Total $81,000** **RT % of Annual Total 90%**
Annual Report Reference:	**#11, Page 271, R-35**	

OBJECTIVES: The overall objective of this project is to develop, standardize, and validate a practical, cost-effective instrument to measure handicap severity. Such an instrument should ideally yield a profile for an individual that would measure components of handicap severity as follows: (1) degree of handicap in mobility; (2) degree of handicap in self-care; (3) degree of handicap in motivation and psychological independence; (4) degree to which individual perceives problems to exist in personal, social, family, and vocational adjustment; (5) impact of demographic variables on employability; and (6) related factors.

METHODOLOGY: Establishment of a methodology for this study will include the following: establishment of a panel of technical consultants, completion of literature search, evaluation of instruments or items for inclusion in a pilot battery, content analysis of resultant items, analysis of pilot inventory by reading specialists, preliminary field test of pilot battery with no less than 30 severely disabled clients, revisions of the inventory, reliability checks, concurrent validity tests, alternative weighting procedures, and norm development.

FINDINGS TO DATE: The research methodology has been reviewed by RSA. Since approval for this project did not come until the latter part of 1976, recruitment is only now being finalized so that work may begin.

APPLICABILITY: Once the multiple-factor instrument has been developed with an accompanying manual to facilitate its use, two forms of the manual will be developed for direct application to rehabilitation. Form A of the manual will be for client-serving personnel, such as counselors and vocational evaluators to aid in documenting eligibility, to sensitize client-serving personnel to differential needs of individual clients, and to assist in the development of the Individualized Written Rehabilitation Program for each client. Form B of the manual will be oriented toward program evaluators to use as a supplement to number of closures, to help specify agency policy and priorities in terms of intake practice, potentially, and to assess employability gain vs. employment.

EDUCATION: A HERITAGE AND FUTURE FOR OREGON

University of Oregon (RT-16)
Mental Retardation Rehabilitation Research and Training Center

CORE AREAS

Program Related Assessment

Development of client assessment strategies as well as specific instruments that measure the behaviors of mentally retarded adults that are critical determinants of their potential for community adjustment.

Professional Growth and Development

Activities aimed at improving our understanding of the major roles and functional demands of supervisory and management personnel in rehabilitation agencies; e.g., staff development specialists, rehabilitation educators, and first-line supervisors of rehabilitation counselors.

UNIVERSITY OF OREGON

Andrew Halpern, Ph.D., Director
University of Oregon Mental Retardation
Rehabilitation Research and Training Center
306 Clinical Services Building
Eugene, Oregon 97403

PROJECT TITLES BY FY 1977 STATUS

COMPLETED

ABSTRACT NO.

The Development of a Model for Evaluating the Relationship between EMR Work/Study Programs and the Community Adjustment of Terminated Pupil Clients (Andrew Halpern, Ph.D.) 317

Community Group Homes for the Developmentally Disabled (Gail O'Connor, Ph.D.) 318

Program for the Analysis of Deinstitutionalization Resources (Subcontract with the Council for Exceptional Children) (David Braddock, Ph.D.) 319

Cost Analysis and Program Budgeting of Community Residential Facilities and Rehabilitation Programs (Gail O'Connor, Ph.D.) 320

Measuring Client Gain in Group Homes for the Retarded (Larry Irvin, Ph.D.) 321

CONTINUING

Predicting Rate of Acquisition and Production of Complex Industrial Tasks by Institutionalized Moderately and Severely Retarded Adults (G. Thomas Bellamy, Ph.D.) 322

Training Evaluation Kit (Philip Browning, Ph.D.) 323

NEW

An Analysis of Public Assistance/Social Services for the Mentally Retarded (Mark Litvin, M.A.) 324

A Follow-Up Study of Rehabilitation Short-Term Training (Michael A. Smith, M.S.) 325

Supervision in Vocational Rehabilitation (William English, Ph.D.) 326

Research Needs in Vocational Rehabilitation (Gilbert Foss, Ph.D.) 327

A Sociological Look at the Impact of Normalization (Philip Browning, Ph.D.) 328

Evaluation of Retarded Student Achievement in Career Education Programs (Larry K. Irvin, Ph.D.) 329

DISCONTINUED 1977

Temporal Ordering of Audio and Visual Events by Retarded and Normal Persons: An Index of Attentional Switching (Charles Silverstein, M.A.)

Recreational Activities and Opportunities of Deinstitutionalized Retarded Adults (Gail O'Connor, Ph.D.)

317 The Development of a Model for Evaluating the Relationship between EMR Work/Study Programs and the Community Adjustment of Terminated Pupil Clients

Principal Investigator	Andrew Halpern, Ph.D.	
FY 1976		
Status:	Completed	
Dates:	September, 1969-August, 1975	
Cost:	Annual $21,508	Projected Total $250,000
	RT Annual $21,508	RT % of Annual Total 100%
Annual Report Reference:	#10, Page 16, R-11	

OBJECTIVES:

1. To obtain preliminary information on the difficulty, reliability and predictive validity of the Social and Prevocational Information Test Battery (SPIB) developed by the Center. The SPIB is the first test battery that assesses those areas of social and prevocational competencies considered most important by secondary teachers of educable mentally retarded pupils. To date, the SPIB appears to be the only assessment tool that provides measures of wide ranging social and prevocational competencies that can be used with clients of these agencies.
2. To obtain normative information and internal consistency estimates for the SPIB based on performance of out-of-Oregon secondary level EMR pupils.
3. To investigate the concurrent validity of the SPIB with measures of post-school adaptation.
4. To explore the potential use of the SPIB with moderately retarded individuals in institutional, group home, or school settings.
5. To investigate the effects of guessing on SPIB results.

The major outcome of this research activity will be the presentation of empirical evidence demonstrating the relationship between the outcomes of work-study programs and the subsequent community adjustment of EMR young adults.

METHODOLOGY:

1. **Normative and Reliability Studies:** The nine tests in the revised (1974) SPIB were administered twice over a two-week period to approximately 460 junior and 460 senior high school EMR pupils throughout Oregon during the 1973/74 academic year to establish comparison group norms and test-retest reliability.
2. **Predictive Validity Study:** The 1973 version of the SPIB was administered to 220 graduating senior EMR pupils at the end of the 1973 academic year. Since 130 of these students were assigned to a vocational rehabilitation counselor, the counselor was asked for an assessment of the post-school adjustment of his client in the areas of community integration, economic self-sufficiency, communication, family living and personal habits to establish predictive validity of the SPIB.
3. **Out-of-Oregon Norming and Reliability Study:** During 1974-75, the SPIB was administered by classroom teachers to 74 senior high EMR pupils in Anchorage, Alaska, and to 71 senior high and 73 junior high EMR pupils in Louisville, Kentucky.
4. **Concurrent Validity Study:** During 1974-75, the SPIB was administered to 105 EMR clients of the Oregon Division of Vocational Rehabilitation (DVR). With no knowledge of test results, counselors assessed their clients' current levels of community adaptation on a rating instrument that provided five scores reflecting general adaptation in the areas evaluated by the SPIB: community integration, economic self-sufficiency, communication, family living, and personal habits.
5. **Extension of the SPIB for Use with Moderately Retarded Individuals:** Difficult item vocabulary was replaced by more familiar words. Instructions were simplified and made more concrete. A screening test was developed to determine which individuals could respond appropriately to test materials. Fifteen moderately retarded residents of Fairview State Hospital were tested individually during the fall of 1974, using the revised version of the SPIB.
6. **Study of Guessing Patterns of EMR Individuals:** The data from #1 above were analyzed separately by "true" vs. "false" subtests to determine the nature of guessing patterns or systematic response bias.

PROGRESS AND FINDINGS: The SPIB is now ready for widespread utilization as a tool for screening, diagnosis, and program evaluation. Furthermore the content areas specified under each of the nine tests of the SPIB provide the user with a general set of objectives considered important to post-school adjustment. The potential user population for the SPIB seems to be continually growing as new contacts are made with other agencies. Strong interest in using the SPIB has been expressed by many secondary teachers of EMR in Oregon and numerous out-of-state requests have been received.

1. **Out-of-Oregon Norming and Reliability Studies:** Initial variability, difficulties and internal consistency reliability estimates remained stable across Oregon and out-of-Oregon groups.
2. **Concurrent Validity Study:** A moderately high concurrent relationship was found between client performance on the SPIB and ratings by DVR counselors of their clients' levels of community adaptation. These results verify the initial estimates of validity for the SPIB.
3. **Extension of the SPIB for Use with Moderately Retarded Individuals:** SPIB tests appear to be much more difficult for moderately retarded individuals than for secondary level EMR students. However, moderately retarded persons seem to be able to understand and respond to a T/F knowledge test format.
4. **Guessing Studies:** Analysis of the data reveals that false items were more difficult than true items on all SPIB tests, and that false items were more reliable than the true items. Both findings lead to the conclusion that when EMR examinees guess, they tend to guess true more often than false.

APPLICABILITY: As a result of the publication and dissemination by CTB/McGraw-Hill, Inc., the potential user population has been expanded. Special education teachers, vocational rehabilitation personnel, work-study coordinators, and personnel in institutional settings now have a psychometrically sound test battery available for use in assessing individual achievement and program effectiveness. The pilot study that examined the potential extension of the SPIB for use with moderately retarded individuals has led to a new project whose goal is to produce a version of the SPIB suitable for use with that population. Group home operators and personnel in institutional settings will benefit from the availability of such an instrument.

318 Community Group Homes for the Developmentally Disabled

Principal Investigator:	Gail O'Connor, Ph.D.	
FY 1976		
Status:	Completed	
Dates:	June, 1972-June, 1975	
Cost:	Annual $9,331 RT Annual $9,331	Projected Total $300,000 RT % of Annual Total 100%
Annual Report Reference:	#10, Page 38, R-21	

OBJECTIVES:

1. To ascertain the population of community residences for the developmentally disabled in the United States and provide information regarding their capacity, development, and where appropriate, the reasons for their attrition;
2. to gather data on the resident population of these facilities, sources of funding costs, and start-up methods which could provide the basis of guidelines for the further establishment of community residential facilities as an alternate to institutional care;
3. to identify needed supportive services in the community;
4. to gather information about community residences for the developmentally disabled in order to indicate the extent to which they embody the concept of normalization and community integration.

METHODOLOGY:

1. A national survey was carried out by mail to ascertain the population of community residences for the developmentally disabled in the United States and to provide information on their historic and administrative characteristics.
2. A multi-stage in-depth sampling of community residential facilities will investigate characteristics, level of functioning, and life styles of individual residents.

FINDINGS TO DATE:

Data based on interviews on 105 facilities show the following:

1. Over one half of the homes are located in a town or smaller city. Larger cities of 50,000 or more accommodated about 40% of the homes, while only 10% were in rural areas. Analysis by type and size of facility shows no significant differences.
2. The greatest single choice (56%) for type of housing was a home that had previously been used as a private residence. Fifteen percent of the residence operators reported facilities especially designed for the use of retarded or handicapped persons. Various types of buildings provided the remainder of the homes such as private apartments, motels, hotels, and a number of previous churches, convents, and college dorms that had been converted for this purpose.
3. There was a good deal of variety in the estimated age of the residential structure. In spite of the fact that nearly 70% of the residences were found to be 20 or more years of age, 71% of the residences were reported to be in good to excellent condition, and only four residences were reported in poor condition.
4. Residences tended to be primarily in residential areas: 88% had a neighbor within one block or less; nearly as many had a home on both sides. In addition, three quarters of the residences did not have fences on their grounds.
5. Most of the homes were within one to six blocks of a store or public transportation (although only 63% of the operators reported that public transportation was indeed available). Most residences had a private car (79%) or bus (34%).
6. The majority of homes would seem homelike and quite normal in terms of conditions and level of housekeeping.
7. The average number of residents per bedroom was 1.6 with two being the model response. Further, in 84% of the cases there was a personalized area around the individual's bed; and a "privacy area" was available in 37% of the cases.
8. There was either a pay phone (7) or a non-pay phone available to residents in practically all of the homes.

   Although a broad age range was found among the residents of community facilities, from the very young to senior citizens, young adults do predominate.
9. The median length of residence is approximately 16 months, although the near is 23 months due to a fewer long term residents. Slightly over one-fourth of the residents have been in the facility six months or less.
10. Almost three quarters of the residents are engaged in some program in the community or working there. Nevertheless, there is still just over 15% of the population estimated to be receiving training only on the residential grounds. The conclusion that almost one-tenth of the population are not involved in any program must be tempered by the possibility of involvement in an unlisted program.
11. CRF's were located throughout the United States, however, one-half of the facilities were located in six states.
12. Most residents share a bedroom with only one or two other persons.
13. Over two-thirds of the facilities were considered "normalized," however, since normalization of facility was related to the size of the facility, over one-half of the residents were living in non-normalized facilities.
14. Community opposition, mostly by neighbors, at the time of development was faced by about one-third of the facilities; attitudes were reported to have changed because of the behavior of the residents and staff efforts.
15. There were two primary staffing patterns, (a) full-time administration and direct-care staff primarily in large facilities and those serving children, and (b) houseparents most common in small facilities and those serving older residents. The average staff to resident ratio was .52, or one staff person for every two residents. This ratio was higher for children and adolescents, and lower for adults. Primary causes of staff turnover were low pay, long hours of responsibility and little privacy, especially for live-in staff.
16. Virtually all facilities used one or more types of community services; the most satisfaction was expressed with religious, medical, and dental agencies.
17. Ninety percent of the residents were in facilities reporting a need for one or more of 15 types of community services; nearly one-half are living in facilities needing four or more services. One-third of the facilities reported need educational services and vocational training.
18. Most residents had basic self-help skills and over 80% were estimated to have an IQ of 40 or above. Over one-half of the residents moved to the CRF directly from an institution, and an additional 10%

had a history of institutionalization. The residents' median length of stay in the institution was 10 years, and one-quarter of them had lived in an institution for 30 years or more.

19. Two-thirds of the residents had periodically reviewed developmental plans, although the content and complexity of the plan varied considerably.
20. Of the residents, 14% had paid jobs in the community; 43% were in work training programs; 26% were in sheltered workshops; 47% were attending some school classes; 31% were in school as their primary program; 8% were in non-vocational activity centers, and/or on-grounds training; 4% were not reported to be in programs or receiving any training.
21. Most residents had home responsibilities. The proportion of residents having a household task decreased as the complexity of the task increased; only 7% of the residents, i.e., young or severely disabled ones, had no responsibilities in the home.
22. The most popular community activities were visiting restaurants and snack bars, going shopping, and recreation, both indoor and outdoor.
23. One-half of the residents had regular contact with their families. Fifty-seven percent had friends outside the facility which they both visited and entertained as guests. One-fifth of the residents dated.
24. Facility managers felt that 4 out of every 10 residents would be able to live independently in the community in the future.

APPLICABILITY: It is expected that the results of this study will be utilized at a national as well as state and local level. At the national level it will provide backup information for guidelines. Further, there are no foreseeable barriers to the acceptance and usage of the project results by both the consumers and program planners. The consumers, developmentally disabled confined to institutions or "in line" for institutionalization, will be the beneficiaries. The operators of facilities will be furnished with sufficient information and data to guide them, whether they are profit or non-profit entities. The program planners and the fiscal policy makers will have recorded data to guide them in determining policies and for allocating funds.

319 Program for the Analysis of Deinstitutionalization Resources (Subcontract with the Council for Exceptional Children)

Principal Investigator:	David Braddock, Ph.D.	
FY 1976		
Status:	Completed	
Dates:	September, 1974-August, 1975	
Cost:	Annual $130,000 RT Annual $130,000	Projected Total $130,000 RT % of Annual Total 100%
Annual Report Reference:	#10, Page 58, R-33	

OBJECTIVES:

1. To gather and analyze trends from state administrative documents pertinent to the Community Alternatives and Institutional Reform Planning Grant Program (CAIR).
2. To analyze trends from survey data collected by the Accreditation Council for Facilities for the Mentally Retarded (ACFMR).
3. To develop and disseminate nationally 4,000 copies of an annotated information and training material bibliography which documents innovative efforts enabling mentally retarded individuals to move out of institutional settings.

The purpose of these analyses was to discover the presence or absence of national trends in deinstitutionalization and institutional reform and further, to discern the critical deficiencies impeding deinstitutionalization efforts as revealed by these trends.

METHODOLOGY:

Objective 1: Trend Analysis of CAIR Administrative Documents. Analyses techniques used included classification and comparison techniques (Selltiz, Jahoda, Deutsch, & Cook, 1959) and the content analysis of qualitative material as discussed by Cartwright (1966). To guide analytical thought, operational definitions for deinstitutionalization and institutional reform employed were those developed by the National Association of Superintendents of Public Residential Facilities for the Mentally Retarded (PCMR, 1974).

Documents were gathered via a survey letter which was sent to state Developmental Disabilities Council Chairpersons and Staff Directors, and to HEW Regional Office personnel in March, 1975. The 34 persons ranged from short letters to lengthy planning documents and final reports. The content of each was summarized, and State Document Fact Sheets were developed. These were then evaluated for the presence or absence of trends.

Objective 2: Trend Analysis of Data Emanating from ACFMR Surveys. The ACFMR data consisted only of a list indicating the number of nonaccredited facilities (N = 35) and accredited facilities (N = 13) found to be in less than full compliance with the standards listed. Constituent elements for object-classification were the ACFMR topical requirements (1975). Object-classifications were evaluated for the presence or absence of trends. The absolute and proportional numbers of critical standards for each major and minor topical requirement were determined within each facility category. Then, topical requirements were rank-ordered by percentage and also by the absolute number of critical standards contained therein. Both proportional and absolute indicators for rank ordering were used to enhance the authenticity of trends noted.

Objective 3: Dissemination of an Annotated Bibliography. The identification of materials for the bibliography involved both field research and library research techniques. The development and distribution of a publication was accomplished by completing the following tasks: (1) Adoption of inclusion criteria; (2) implementing a nationwide mail survey and follow-up of potential producers of information; (3) conducting computer searches of national information systems; (4) conducting library handsearches of literature compilations, such as **Mental Retardation Abstracts;** (5) conducting library handsearches of 21 film catalogs; (6) conducting a telephone survey of Developmental Disabilities consultants in the HEW Regional Offices to identify materials not otherwise disclosed; (7) development and editing of annotations and preparation of a publishable document; (8) development of a mailing list of 1,500 administrators, planners, personnel trainers, and others who might find the publication useful; and (9) reproduction of 4,000 copies.

FINDINGS TO DATE:

Deinstitutionalization. Analysis of the information contained in the state submissions disclosed the presence of numerous trends in deinstitutionalization. Nineteen trends were discovered among actions recommended to augment deinstitutionalization in 14 different states; 3 trends were discovered among problems identified impeding deinstitutionalization in 7 different states. From among the 22 trends disclosed, at least two Critical Deficiencies seemed to be major obstacles impeding deinstitutionalization efforts nationally. That is, they would need to be addressed first, before other activities associated with deinstitutionalization could proceed.

1. There are not enough alternative residential services for institutional residents, or persons at risk of institutionalization, in the nation's communities.
2. There is not the variety of supportive services necessary to sustain individuals placed, or to be placed, into alternative residential facilities in the nation's communities.

In what might well be listed as a third critical deficiency impeding deinstitutionalization, states almost uniformly noted that **among the generic agencies whose responsibility it is to provide supportive services to community members, there is not the cooperation necessary** to allow the unfettered delivery of community-sustaining supportive services to the developmentally disabled. Many states also recognized problems or made pointed recommendations about the **underfinancing of community-based residential and supportive services.** It is interesting to note that the preliminary findings of a study of group homes by O'Connor and Sitkei (1973) indicated that "inadequate funding" was **the** primary concern among community-based group home operators.

Institutional Reform

Review and classification of the submissions disclosed that 1 state offered legislative recommendations; 12 states offered organizational recommendations; 6 states recommended budgetary actions; and 7 states made client-centered recommendations to augment institutional reform. No state identified legislative problems **per se** in institutional reform; 3 states identified organizational problems; 5 states noted budgetary problems; and 4 states specified client-centered problems which were impeding institutional reform.

The number of state submissions being used to disclose trends in each classification category was small, making broad generalizations unsound. However, three common program deficiencies were mentioned most frequently either as a problem or as a recommendation:

—That insufficient public funding is a major factor inhibiting institutional reform efforts.

- That the variety and quality of educational and habilitational services available to institutional residents is inadequate.
- That the lack of individualized program planning and evaluation for institutionalized residents is a major problem.

APPLICABILITY: Since the methodologies addressing some of the project's activities focused inherently on identifying "critical programmatic deficiencies" impeding deinstitutionalization and institutional reform, findings reported here are pertinent targets for Federal Government deployment of resources in these areas.

Further, the explicit design of the annotated bibliography was to offer practical suggestions for aiding implementation of model programs which might be exportable from one community to another. Wide dissemination of this publication to rehabilitation and allied professional personnel may enhance this adoption process.

320 Cost Analysis and Program Budgeting of Community Residential Facilities and Rehabilitation Programs

Principal Investigator:	Gail O'Connor, Ph.D.	
FY 1976		
Status:	Continuing	
Dates:	July, 1974-May, 1977	
Cost:	Annual $168,280 RT Annual $12,420	Projected Total $300,000 RT % of Annual Total 7%
Annual Report Reference:	#10, Page 100, R-32	
1977		
Status:	**Completed**	
Dates:	**July, 1974-June, 1976**	
Cost*:	**Annual –** **RT Annual –**	**Projected Total $300,000** **RT % of Annual Total –**
Annual Report Reference:	**#11, Page 11, R-32**	

* Project supported primarily by two supplemental grants: 56-P-50255/0-02 and 51-P-50256/0-02. No RT funds requested for FY 1977.

OBJECTIVES:

1. To obtain an accurate analysis of the costs of operating community residential facilities, and to relate these costs to the level of functioning of residents and services provided by the facilities.
   a. Design and implement a fiscal reporting system which is relevant to community residential facilities;
   b. Develop a manual which provides guidelines for utilizing the fiscal reporting plan.
2. With CRF staffs, to develop a model which would structure efforts to develop goals and objectives for their facilities and for residents, thus making possible future costing of objectives and services.

METHODOLOGY: Initial project activities focused on development of a comprehensive fiscal reporting plan specifically for community residential facilities. This system includes a chart of accounts aimed at encompassing those expenses which are pertinent to a CRF, along with a manual of instructions. Materials were developed to obtain information regarding the level of functioning of residents and the services provided by the facilities. These forms were then used by the participating CRF's. A sample of eight homes participated in a pretest of the fiscal reporting plan. As a result of feedback from these facilities, revisions and additions were made to the reporting system. A sample of 29 residential facilities in Regions IX and X participated in the full project. Training workshops on the use of the fiscal reporting plan were held prior to data collection. Longitudinal cost information was provided by these facilities on a monthly basis for from 6-18 months. Continuous monitoring by phone and field visits were considered mandatory, and feedback reports were provided to facilities for verification. A final workshop was held to provide feedback to project participants and suggestions to staff.

FINDINGS TO DATE: As is common in most human services and businesses, personnel costs account for over two-thirds (68%) of the total operating costs. This in turn represents on the average 53% of the total costs (all operating costs and capital costs). On the whole, this is undoubtedly an underestimation of the full amount of staff time involved because it was limited to 40 hours per week (i.e., the amount for which a person is paid). Many staff members work far more hours per week, especially live-in houseparents. This is a situation which has been found true nationwide (O'Connor, 1976). Further, many owners of the profit oriented facilities do not pay themselves salaries, but rather, allow the funds which could be used to pay them a salary to be shown as profit. The staff costs per resident per month vary considerably. At the most expensive extreme is a facility with multi-handicapped children receiving fairly intensive programming and at the other end is a home for adults with sheltered employment.

Capital costs are, for the most part, facility buildings and grounds. Such capital costs are much more difficult to measure than operational costs. In fact, as Burns and Hendrickson (1972) point out, "The greatest diversity of valuation and reporting methods in accounting is found among non-current accounts" (i.e., capital costs, buildings, etc.).

To obtain some idea of the investment per resident for different types of buildings, information was obtained about the square feet of usable living space per resident, based on planned capacity. The costs per square foot, square feet per resident, investment per resident and capital cost per resident per month were calculated and are reported in detail in RT-16 Report of Progress #0-11.

The new system developed by project staff is entitled "Accounting System for Group Homes for Developmentally Disabled Persons" (Sipe, 1976). It includes three sections: (1) an Accounting Handbook; (2) a Practice Set; and (3) a Reporting Manual. The Handbook and Practice Set were designed to be instructional in nature and were aimed at providing a brief discussion of accounting procedures and the uses of accounting information for managerial purposes.

A Center working paper entitled "Systematic Planning and Programming for Group Homes" (Sitkei, 1976) presents the findings for Objective Two.

APPLICABILITY: The findings of this study should be useful at a variety of levels. Most directly affected are community residential facilities, in that a financial reporting system related to program budgeting will be available for their use.

At a different level, the results will provide developers, program planners, and administrators at all levels with much needed information regarding actual costs of providing given types of services to individuals at different levels of functioning. This knowledge should provide a basis for more sophisticated and accurate program planning and budget allocations.

321 Measuring Client Gain in Group Homes for the Retarded

Principal Investigator:	Larry Irvin, Ph.D.	
FY 1976		
Status:	New	
Dates:	July, 1975-July, 1977	
Cost:	Annual $68,640	Projected Total $68,640
	RT Annual $14,487	RT % of Annual Total 22%
Annual Report Reference:	#10, Page 109, R-34	
FY 1977		
Status:	**Completed**	
Dates:	**July, 1975-June, 1976**	
Cost:*	**Annual –**	**Projected Total $65,000**
	RT Annual –	**RT % of Annual Total –**
Annual Report Reference:	**#11, Page 27, R-34**	

* (Project supported primarily by Grant 56-P-71110/0-01. No RT funds requested for FY 1977)

OBJECTIVES:

1. Develop a preliminary revision of SPIB test items and test administration procedures in order to reduce the difficulty of the battery — completed in FY 1975.
2. Field test the revised administration manual in order to insure its clarity and applicability with group home operators — completed FY 1975.
3. Field test the revised battery in order to insure its reliability with a population of group home residents.
4. Ascertain the validity of the revised SPIB within a population of group home residents.

METHODOLOGY: **Preliminary Revisions of the SPIB.** Specific test items which contained inappropriately difficult language were revised and test administration procedures were rewritten in language that is easier to understand. In addition, a pretest was developed for use in screening group home residents in terms of their ability to respond appropriately to SPIB test items.

Revision of Test Manual for Group Home Administrators. The test administration procedures were revised on the basis of observations made during initial field testing. The wording of the test administration procedures was finalized on the basis of a second set of field test observations.

Determination of SPIB Reliability. Group statistics, item analyses, and reliabilities of samples of approximately 400 residents of 25 group homes and 128 Pennsylvania TMR students were calculated and analyzed. The reliability of the revised SPIB was improved by rewriting items shown to be weak by the previous item analyses.

Exploration of the validity of the Revised SPIB. A behavioral rating scale was developed to use as a criterion instrument suitable for assessing the validity of the revised SPIB was developed. The content areas of the SPIB served as its structural foundation. Each checklist item was refined until it was judged to be clearly and easily applicable by a sample of group home staff. The validity of the revised SPIB was developed. The content areas of the SPIB served as its structural foundation. Each checklist item was refined until it was judged to be clearly and easily applicable by a sample of group home staff. The validity of the revised SPIB was calculated by using the criterion instrument to rate approximately 150 group home residents and correlating these criterion and revised SPIB scores.

FINDINGS TO DATE: Early activity to date has focused on lowering the vocabulary level of the items and instructions, revising and adding directions for administration and scoring, and developing a two-part pretest to serve as a screening instrument. Changes in administration directions were based on results of field tests of the administration manual in seven Oregon and Washington group homes. Changes in test format from true/false to yes/no also resulted from field testing, when it was determined that moderately retarded persons have difficulty conceptualizing the terms "true" and "false."

A sample population of approximately 600 residents from about 30 group homes located in Washington, Oregon, Idaho, Nevada, and Arizona (five western states) has been identified for initial field testing of the revised SPIB.

Descriptive Information. The revised SPIB-Form T proved to be moderately difficult for the sample of group home residents and slightly more difficult for the (Pennsylvania) TMR classroom sample.

Reliability Information. For the group home sample the reliability estimates for the SPIB-Form T indicate that each test is composed of a set of homogeneous items. The total battery reliability was quite high. The reliability estimates for the Pennsylvania TMR student sample remained high, although somewhat lower than those obtained with the group home residents.

Validity. The concurrent behavioral validity of the SPIB-Form T was assessed by correlating the criteron measures with the SPIB-Form T scores. The relationship between knowledge as measured by the SPIB-Form T and actual performance as measured by the BRF proved to be a strong one. In addition, results indicate that the pretest that was developed is successful in identifying those individuals for whom SPIB-Form T assessment is appropriate.

APPLICABILITY: The major result of this research project has been the development of a battery of tests which will enable operators of group homes for the retarded, vocational rehabilitation counselors, and educators and community placement personnel in institutional settings to assess individual strengths and weaknesses as a basis for prescriptive remediation. Pre/post measurement also permits evaluation of program effectiveness with respect to the achievement of social and prevocational competencies.

322 Predicting Rate of Acquisition and Production of Complex Industrial Tasks by Institutionalized Moderately and Severely Retarded Adults

Principal Investigator: G. Thomas Bellamy, Ph.D.

FY 1976
Status: Continuing
Dates: July, 1974-May, 1977
Cost: Annual $51,920 Projected Total $75,000
RT Annual $12,322 RT % of Annual Total 24%
Annual Report Reference: #10, Page 81, R-31

FY 1977
Status: Continuing
Dates: July, 1974-June, 1978
Cost: Annual $35,816 Projected Total $100,000
RT Annual $30,573 RT % of Annual Total 85%
Annual Report Reference: #11, Page 65, R-31

OBJECTIVES:

1. To evaluate further the psychometric characteristics and utility of two assessment instruments, the **Trainee Performance Sample** and the **Becker Adjective Checklist,** for predicting training time and facilitating training selection;
2. To evaluate the efficiency of the match-to-sample training procedure and the relative efficacy of match-to-sample and color coding/fading techniques;
3. To evaluate the effects of stimulus feature manipulation in vocational skill training procedures on long-term retention;
4. To evaluate the effects of various floor supervision techniques used in the Specialized Training Program.

METHODOLOGY:

1. The subject pools consist of 300 severely retarded residents of Fairview Hospital and Training Center and 15 severely retarded individuals involved in the sub-contract sheltered workshop component of the Specialized Training Program.
2. Instrument development activities involved continued validation of the Trainee Performance sample and determination of stability of scores on the Becker Adjective Checklist which may be useful for examining attitudes of others toward retarded persons.
3. The match-to-sample study involved examining the effects of match-to-sample training on one relevant dimension upon generalization of match-to-sample behaviors to other stimulus dimensions. A multiple baseline design was used with three profoundly retarded subjects.
4. The study investigating the effects of stimulus feature manipulation upon long-term retention involved retraining 10 randomly selected subjects from each of last year's stimulus factor research on the criterion bicycle axle/nut assembly without color coding or faded cue disparities.
5. In the study of floor supervision effects, three severely retarded STP workers who exhibited substandard work served as subjects. The training task was on 11-wire cable construction. A multiple baseline design was used.

   Training variables were: (1) separation of training and production, with workers entering a production setting only after learning to complete a task independently; (2) structuring of interaction between staff workers in order to provide presumed social reinforcement for task-related behaviors; (3) partial immediate payment for work completed; (4) immediate quality control of all products; and (5) maintenance of continuous records of productivity.

FINDINGS TO DATE: **Trainee Performance Sample:** Validity studies during the current and previous project years produced generally high negative correlations between TPS scores and trials to criterion on various performance tasks (−.52 to −.81). Higher TPS scores are consistently associated with lower training trials in last year's and the current year's results. But, the nature of the tasks and the magnitude of the relationships vary. Further validation studies will focus on identifying more clearly the kinds of tasks for which the TPS has high predictive validity.

Becker Adjective Checklist: Collection of the second series of ratings by ward staff has just been completed. Data analysis is currently underway and findings will be reported upon completion of all analyses.

Retention Study: The results of the study examining effects of stimulus feature manipulation on long-term retention demonstrated that there are no differences between the three original stimulus feature manipulation training procedures in impact on long-term retention. And, on the whole, the results suggest that retention is facilitated by such training. Trials to criterion did not increase significantly from original criterion learning training to retention training. It appears that, once trained on given assembly tasks involving trained discriminations, individuals can be assigned to other production tasks and returned to any trained task without the need for great efforts at retraining.

Match-to-Sample: Two of the three subjects quickly learned the initial discrimination. One of these showed complete generalization across three other discrimination tasks. The second showed no generalization.

Evaluation of Floor Supervision Techniques: Results demonstrated that functional relationships existed between both rate and variability of subject performance and the initiation of the supervision procedures. Two of the three workers consistently met industrial time standards when the procedure was in effect.

APPLICABILITY: All of these studies are aimed at increasing our training knowledge in order to facilitate practical decision-making in vocational training settings. Assessment of the training required to enable severely retarded individuals to use various learning operations would provide indications of which operations can be most effectively and economically taught and then used.

323 Training Evaluation Kit

Principal Investigator:	Philip Browning, Ph.D.	
FY 1976		
Status:	New	
Dates:	March, 1975-December, 1976	
Cost:	Annual $36,830 RT Annual $32,830	Projected Total $55,000 RT % of Annual Total 89%
Annual Report Reference:	#10, Page 118, R-35	
FY 1977		
Status:	**Continuing**	
Dates:	**March, 1975-February, 1978**	
Cost:	**Annual $18,212** **RT Annual $18,212**	**Projected Total $50,000** **RT % of Annual Total 100%**
Annual Report Reference:	**#11, Page 84, R-35**	

OBJECTIVES: The purpose of this project is to "field test" TEK through the Rehabilitation Continuing Education Programs (RCEP's) in HEW Regions VIII, IX, and X. The four major types of feedback information to be gathered are: (1) ease and accuracy of administration; (2) ease and accuracy of scoring; (3) methods of interpreting the obtained evaluative data; and (4) utilization of TEK data for decision-making and accountability.

METHODOLOGY: R-T Center training staff contracted with RCEP training staff in HEW Regions VIII, IX, and X to field test TEK. The plan consisted of the following steps:

1. R-T staff supervised the use of TEK with five short-term training programs for which each RCEP was responsible;
2. In order to properly supervise, R-T staff arranged four trips for each of the three RCEP's. Two trips were arranged at the site of the first two of five training programs. The remaining two trips were arranged at the site of the RCEP;
    a. Trip 1 (training program 1): The purpose of this trip was for the R-T staff member to administer TEK throughout the training program. The staff member modeled the use of TEK to RCEP training staff member(s);

b. Trip 2 (training program 1): Shortly after training program 1, an R-T staff member visited the RCEP office for a day of debriefing and interpreting the evaluation information obtained for program 1;

c. Trip 3 (training program 2): The purpose of this trip was for the R-T staff member to observe an RCEP training staff member administer TEK throughout the program;

d. Trip 4 (training program 2): Shortly after training program 2, an R-T staff member visited an RCEP office for a day of debriefing and interpreting the evaluation information obtained for program 2:

3. R-T training staff were responsible for data processing and reporting the evaluation information collected by RCEP training staff for the remaining three of five seminars;
4. RCEP training staff from the three HEW Regions attended a 2-day workshop designed to critically analyze and modify TEK. This workshop was held in Eugene, Oregon, during the month of July, 1976.

FINDINGS TO DATE: FY 1976 activities were directed to developing TEK for field testing purposes. In addition, arrangements have been made with RCEP's in HEW Regions VIII, IX, and X to begin the field testing in October, 1975.

The FY 1977 field testing of TEK included 21 rehabilitation short-term training programs serving over 400 trainees/practitioners. Nineteen of the training programs were conducted through HEW Regions VIII, IX and X Rehabilitation Continuing Education Programs (RCEP's), and the remaining three were offered through two Rehabilitation Research and Training Centers.

Additional information, which characterizes the trainees/practitioners served by the 21 training programs, further reflects the representativeness of the population upon which TEK was field tested. There was an approximately equal distribution of trainees from HEW Regions VIII, IX and X respectively, i.e., N = 157, N = 124 and N = 126. Two hundred seventy-eight of the 407 subjects resided in urban settings whereas the remaining 129 were from rural areas.

Based upon the feedback obtained through the field testing, and the instruments' statistical properties, a final set of TEK evaluation booklets have been prepared. These include (1) Program Evaluation Booklet; (2) Follow-Up Evaluation Booklet; (3) Tabulation and Report Forms; (4) User's Manual; and (5) Literature Review and Analysis.

APPLICABILITY: TEK is a comprehensive system for the evaluation of professional short-term training. Based upon a professionally established evaluation model, TEK offers training personnel a way to systematically evaluate short-term educational programs.

324 An Analysis of Public Assistance/Social Services for the Mentally Retarded

Principal Investigator: **Mark Litvin, M.A.**
FY 1977
Status: **New**
Dates: **March, 1976-February, 1977**
Cost: **Annual –** **Projected Total $11,500**
RT Annual – **RT % of Annual Total –**
Annual Report Reference: **#11, Page 99, R-36**

OBJECTIVES: The purpose of this study is to investigate how and to what extent advocate groups for the mentally retarded participated in the initial (1973) state Title XX planning process. Issues examined include: nature and distribution of Title XX material; nature of professional advocate group involvement; nature of relationships between involvement, influence and impact of professional advocate groups; and factors other than professional advocacy that affected Title XX planning process.

METHODOLOGY: A three part questionnaire was sent to the Executive Directors of the 50 state and the Washington, D.C. Associations for Retarded Citizens, and to the 50 staff directors of state and the

Washington, D.C. Developmental Disabilities Councils. The questionnaire was designed to produce information about: demographic characteristics of the population surveyed, the nature and distribution of Title XX information received, and the nature of the involvement of the professional advocates.

In addition, technical notes analyzing major features of preliminary and final title XX plans were reviewed to document inclusion of mentally retarded individuals as target groups. Also, expenditure reports from all states and Washington, D.C. were reviewed to determine the percentage of each state's expenditures on services to mentally retarded individuals.

FINDINGS TO DATE: Data are currently being collected and analyzed, and will be reported at the end of the project year.

APPLICABILITY: The findings of this project should be of use to a wide variety of people providing services to the mentally retarded. This would include vocational rehabilitation counselors, public welfare caseworkers, and Developmental Disabilities Council administrators. Recognition of the importance of Title XX planning should lend impetus to the expansion of social services.

325 A Follow-Up Study of Rehabilitation Short-Term Training

Principal Investigator:	**Michael A. Smith, M.S.**	
FY 1977		
Status:	**New**	
Dates:	**March, 1976-August, 1976**	
Cost:	**Annual –** **RT Annual –**	**Projected Total $4,600** **RT % of Annual Total –**
Annual Report Reference:	**#11, Page 110, R-37**	

OBJECTIVES: The purpose of this study is to investigate a strategy for follow-up evaluation of rehabilitation short-term training.

It will examine the relative efficacy of two different approaches to conducting a follow-up evaluation of the impact of short-term training: a mail out procedure and a personal interview procedure, both involving response to open-ended items on a follow-up questionnaire. Further, the study will examine whether a relationship exists between various trainee characteristics and/or immediate outcome evaluations, and the dependent variable of change scores on the open-ended follow-up questionnaire.

METHODOLOGY: Sixty-two of 70 agency trainees who participated in these one-week seminars at the Center and who completed the immediate outcome evaluations immediately after training were randomly divided into two groups of 31. Group A received the follow-up mail survey and Group B were personally interviewed. In Group A, 22 (71%) completed the mailed questionnaire, and in Group B, 29 (94%) completed the personal interview.

The questionnaire and interview consisted of a set of open-ended items directed toward Professional Practice change which consisted of stimulus words such as mental retardation, vocational assessment, deinstitutionalization, severely retarded, etc. These items were derived from program content of the seminars. Respondents were asked to describe, in an open-ended manner, any changes in their behavior with respect to these 16 stimulus words (phrases) that occurred at least partially as an outcome of their training experience.

Two doctoral candidates in the Departments of Counseling and Sociology served as the interviewers for Group B. Neither of them were acquainted with the former trainees nor had experience with the R-T Center short-term training programs. Both were carefully instructed and rehearsed to avoid answering the items in the questionnaire for the subject.

FINDINGS TO DATE: The results clearly demonstrated that the open-ended items of the Follow-Up Questionnaire do reflect changes in professional practice, regardless of the method of data gathering employed. In essence, this finding supports the usage of open-ended items in a mail questionnaire in that responses can provide useful self-report information.

The importance of this finding for training personnel should not be overlooked: The savings in time, money and personnel of a mail-out instrument are apparent. An additional, but no less important, savings related to the mail questionnaire format is that provided by the structure of the instrument itself. The space allotted for responses is limited. Thus, responses to such items are more likely to be brief and to the point. It seems clear that open-ended items on a mailed follow-up questionnaire are both appropriate and feasible.

However, if open-ended items are to be employed in the follow-up evaluation of short-term training, it seems essential, in terms of the results of this study, that such items be streamlined to correspond directly to the key descriptors used to identify the major program emphases of the training seminar.

APPLICABILITY: The results of this study have direct implications for the types of short-term training programs provided to different groups (populations) of rehabilitation practitioners. The possible interaction between characteristics of trainees, the types of training received, and the kinds of changes they report both at the conclusion of training and following a period of time, provide useful information to both training personnel and to state agency personnel. In addition, others involved in both the technology and provision of short-term rehabilitation training, such as RCEP personnel, may be able to generalize from the results of this study to the development and/or improvement of their own instruments for follow-up evaluations.

It is anticipated that the results of this study would provide information that could be utilized for (1) decision-making geared toward program improvement, and (2) accountability of short-term training for rehabilitation practitioners.

326 Supervision in Vocational Rehabilitation

Principal Investigator:	**William English, Ph.D.**	
FY 1977		
Status:	**New**	
Dates:	**May, 1976-June, 1979**	
Cost:	**Annual $105,420** **RT Annual $105,420**	**Projected Total $300,000** **RT % of Annual Total 100%**
Annual Report Reference:	**#11, Page 120, R-40**	

OBJECTIVES:

1. To describe the supervisory process in vocational rehabilitation.
2. To implement, through an original research utilization project, the findings of the proceeding descriptive study of first-line supervision in vocational rehabilitation agencies.
3. To effect widespread dissemination and utilization of the implementation project in public vocational rehabilitation agencies in a multi-regional area.

METHODOLOGY:

1. **Literature review.** Books, periodicals, and manuscripts are being reviewed from a variety of sources to gather the best possible picture of a number of supervision issues, e.g., selection, training, theory, practice, and outcomes.
2. **Individual interviews.** On-site interviews are being conducted with vocational rehabilitation counselors, supervisors, managers, and administrators to supplement data collected via questionnaires and small group need assessment procedures. An interview schedule was developed as a stimulus tool for use in interviewing.
3. **Nominal group process exercises.** This on-site procedure consists of the identification of a need area, which is presented to a small group — usually 10-15 vocational rehabilitation personnel. A useful item in this research has been: "List 4 suggestions which, if implemented, would increase the effectiveness of first-line supervisors." The group is then directed by experienced facilitators through four steps: problem identification, listing of problems, clarification and revision of problems, and problem resolution.

4. **Questionnaires.** Survey questionnaire booklets consisting of questions concerned with supervisory selection practices, training, evaluation, and how supervisors assist counselors to rehabilitate retarded clients have been mailed to a stratified random sample of counselors, supervisors, managers, and administrators employed in more than 40 general vocational rehabilitation agencies.

FINDINGS TO DATE: Activity to date has focused on five major task areas: (1) staff recruitment; (2) planning; (3) literature/materials search; (4) instrument construction; and (5) data collection.

Staff recruitment. This step was completed with the hiring of a Research Associate with extensive supervisory/administrative experience in state service delivery to developmentally disabled persons, and in the recruitment of an experienced Research Assistant/Programmer.

Planning. Major planning steps completed are: (1) receiving project endorsement from the Council of State Administrators of Vocational Rehabilitation (CSAVR); (2) formation of a consumer task force of rehabilitation practitioners as project advisors; (3) planning research design and methodology; and (4) receiving project approval of University of Oregon's Committee for Protection of Human Subjects.

Literature/Materials search. All relevant professional literature was reviewed for implications for the current study. Additionally, all existing materials being used by the vocational rehabilitation agencies in areas of supervisory (1) selection, (2) training, (3) practice, and (4) evaluation have been obtained and reviewed.

Instrument construction. Two kinds of instruments were constructed: an interview schedule and questionnaires. Both types were developed by project staff but both were substantially influenced by input from project advisors and project consultants. The interview schedule and the mailed questionnaires both dealt with the areas of supervisory selection, training, practice, evaluation, demographic background and the supervision of counselors' work with mentally retarded persons.

A substantial amount of time and effort was devoted to the development and refinement of the questionnaires, which represent the basic and objective research instruments. The descrete steps involved in this effort follow:

(1) **Drafting questionnaires** – the project staff generated a large comprehensive pool of items. These items were subsequently grouped into six content areas related to supervisory selection, supervisory training, supervisory practice, supervisory evaluation, demographic background, and supervision of counselors work with mentally retarded persons.

(2) **Preliminary technical and content review** – other R-T Center staff and an outside management consultant reviewed the six questionnaires measures and made suggestions for improving the instruments technical quality and content relevance.

(3) **Revision of questionnaires** – questionnaires were revised to reflect the input of other R-T Center staff and the outside management consultant.

(4) **First field testing** – an initial group of state vocational rehabilitation counselors and first-line supervisors evaluated the questionnaires for content and item relevance and to determine the average time for completing questionnaire items.

(5) **Revision of questionnaires** – questionnaires were revised to reflect the input of the vocational rehabilitation agency counselors and supervisors who participated in the initial field testing.

(6) **Second field testing** – a second group of state vocational rehabilitation administrators, managers and trainers evaluated the questionnaires for content and item relevance and to determine the average time for completing questionnaire items. This Advisory Task Force consisted of persons from five western sites.

(7) **Secondary technical and content review** – four outside consultants, three employed by state vocational rehabilitation agencies, closely scrutinized the training and practice questionnaires and made suggestions for improving the instruments' technical quality and content relevance.

(8) **Final revision of questionnaires** – the project staff used the input of the Advisory Task Force group and the outside consultants to make final revisions. Their input allowed staff to quantify a number of open-ended questions and to substantially shorten the length of the various instruments. Subsequently, the instruments were collapsed into two survey research booklets of equal length, approximately 55 minutes. One booklet collected demographic information and researched the content areas of supervisory training and evaluation and the supervisor's work with counselors of retarded persons. The second survey booklet collected demographic information and investigated the content areas of supervisory selection and practices and the supervisor's work with counselors of retarded persons.

DATA COLLECTION.

(1) The questionnaires were mailed to approximately 2,000 vocational rehabilitation personnel in over 40 state agencies. This included vocational rehabilitation counselors, supervisors, managers, and administrators. To date, returns have not been completed.

(2) **Individual interviews.** On-site individual interviews with vocational rehabilitation counselors, supervisors, managers and supervisory clerical staff were conducted in various vocational rehabilitation offices in Oregon, Nevada, California, and New York.

(3) **Small group needs assessment exercises** were conducted in the above-mentioned vocational rehabilitation offices. Small groups of 8-10 counselors and supervisors listed, clarified and prioritized specific suggestions which they believed would improve the effectiveness of first-line supervisors. Both the individual interview and the small group needs assessment material will be used to supplement the questionnaire data to provide a comprehensive picture of the current state-of-the-art of supervision in the vocational rehabilitation agency. Some of this information will bear on the planning and implementation of an original supervisory training demonstration with professional staff persons in the state vocational rehabilitation agencies.

No findings can yet be reported as questionnaires related to the national survey have not been received. Data will be analyzed and reported in final form to the vocational rehabilitation agencies and other consumers in the near future.

APPLICABILITY: This project holds four implications for policy, program and practice changes in vocational rehabilitation. First, it will influence the professional knowledge and skills of first-line supervisors. Second, it will provide administrative leaders with a data base for considering change in the state agencies' present system of first-line supervision. Third, study materials will be of assistance to specialists responsible for the selection, training and evaluation of supervisors. Fourth, it will help rehabilitation counselors to be better consumers of supervisory practices.

327 Research Needs in Vocational Rehabilitation

Principal Investigator:	**Gilbert Foss, Ph.D.**	
FY 1977		
Status:	**New**	
Dates:	**March, 1976-August, 1977**	
Cost:	**Annual $17,508** **RT Annual $17,508**	**Projected Total $35,000** **RT % of Annual Total 100%**
Annual Report Reference:	**#11, Page 141, R-41**	

OBJECTIVES: In order to most effectively determine priority research needs for improving rehabilitation service delivery to mentally retarded consumers, the following objectives have been delineated:

1. To identify those problems of retarded people which are at present the least adequately met, as perceived by
   a. retarded persons in community settings;
   b. service delivery professionals, i.e., vocational rehabilitation counselors and workshop facility personnel.
2. To determine the degree of correspondence between the perceptions of retarded persons and those of service delivery professionals regarding the identified problems.
3. To identify the major research needs emanating from the problems identified by retarded persons and service delivery professionals.

METHODOLOGY: Three sequential steps are being followed in this needs assessment project. First, a literature review was conducted to determine critical domains of living for use in problem identification. The domains chosen for study were: (1) employment; (2) social relationships; (3) and community living. Following the delineation of domains, consultant groups of service delivery professionals and of mildly and moderately retarded consumers were utilized for the purpose of identifying the major problems of retarded persons. The system used for the identification of problems by the consultant groups was the group problem analysis procedure known as the "Nominal Group Technique."

The second step of this study is concerned with expanding and prioritizing the problem identification data obtained from the consultant groups. Separate instruments were developed for each of the two major subject groups, an Interview Schedule for consumers and a questionnaire for service delivery professionals. Step three involves the translation of the prioritized problems into a list of critical research needs. A task force of professional researchers in the field of rehabilitation and mental retardation will be utilized to generate critical research needs for potential study by this center and other interested agencies or individuals.

FINDINGS TO DATE: Consultant nominal groups have been conducted with rehabilitation service delivery professionals and with service delivery consumers. Their input has resulted in two separate lists of problem statements; these problem statements are the content of a forced-choice interview schedule for retarded persons and a rank-order format questionnaire for rehabilitation practitioners.

Data collection through the interview schedule has been completed and the data now being analyzed. Data collection via the questionnaire is in progress and should be completed by early summer. The major findings of this study will be available in the fall of 1977.

APPLICABILITY: The potential users of the materials generated through this project are all professional rehabilitation personnel interested in the major obstacles to rehabilitating mentally retarded persons. The main audience, however, will be rehabilitation researchers in mental retardation, particularly staff from the Oregon R-T Center. The range of potential users will increase in the future as the rehabilitation system responds to the 1973 RSA Amendments concerned with the severely disabled.

328 A Sociological Look at the Impact of Normalization

Principal Investigator:	**Philip Browning, Ph.D.**	
FY 1977		
Status:	**New**	
Dates:	**March, 1976-August, 1977**	
Cost:	**Annual $9,962** **RT Annual $9,962**	**Projected Total $15,000** **RT % of Annual Total 100%**
Annual Report Reference:	**#11, Page 152, R-42**	

OBJECTIVES: The primary objective of the study is to ascertain the impact of normalization on retarded persons placed in a group home. Specifically, the objectives are: 1) To investigate the patterns of daily interaction between consumers (retarded adults) and their significant others (service providers and the general public) employing the method of participant-observation; 2) to analyze the field note and interview data derived from participant-observation at three sociological levels, i.e., interpersonal, institutional, and social interaction; 3) to generate propositions and hypotheses relating to normalization within a sociological context.

METHODOLOGY: Since the purpose of the proposed research is to elucidate the meaning and impact of the normalization process for consumers, service providers, and the general public, participant-observation is a particularly appropriate methodology. The study is being carried out at two levels – descriptive and analytic. At the descriptive level, participant-observation provides techniques to systematically gather data on the process of normalization; at the analytic level, it provides techniques to develop a typology or theoretical model that will furnish an explanation of the factors underlying the observed process of normalization.

The research design was based on the idea that the most valuable information can be obtained from a relatively small group of persons who are significantly involved in the normalization process. Sampling procedures for research informants were adapted to this principle. Instead of discovering typical effects of normalization through extensive sampling, they will be discovered by intensive study of the interrelationship of three levels of analysis, i.e., interpersonal, institutional, and social interaction; 1) The interpersonal level – this is aiming directly at efforts to deal with interpreting, adopting, and incorporating normalization and its interpersonal effects; 2) the institutional level – focus is on the institutions involved in the normalization process, i.e., the group home and work setting, in their attempts to prepare the retarded adult for community living.

The researcher is investigating the contradictions and cross pressures which exist between these institutions and within each one; 3) patterns and forms of social interaction — the normative rules of giving, receiving, and experiencing normalization "in action" are being examined.

FINDINGS TO DATE: As an overt participant-observer, the researcher continues to present himself, in each social setting explored, as a sociologist interested in the assimilation of retarded persons into their community.

The following is a partial list of the social settings and people the researcher has dealt with in the course of investigation: 1) Syracuse, New York: **The "Heart" of the Normalization Movement** — The researcher has spent two months in Syracuse, New York, talking and working with key proponents of the normalization principle including its North American founder, Wolf Wolfensberger. In addition to informal conversations with Wolfensberger and mainline advocates of normalization at The Center on Human Policy, the researcher has visited group homes as well as an institution in the Syracuse area which are applying normalization. In addition, the researcher has attained more structured instruction on normalization by attending a four-day workshop given by Wolfensberger. Through contact with these key people, the researcher has developed a clear understanding of the ideological and programmatic intentions of normalization as well as many of the problems associated with it; 2) **A Group Home for Mildly Retarded Adults** — As an overt participant-observer, the researcher has spent many hours with group home operators and consumers of facility. Through contact with these people, the researcher has developed a trusting and cooperative relationship with them, maximizing their value as informants of the practice of normalization. The researcher has also spent time as a volunteer for the group home, acting as coordinator of its community awareness program, a skills tutor, and in many instances has simply been a "gracious ear" for persons operating and receiving services from the facility. Finally, the researcher has attended staffings on consumers, sat in on counseling sessions between service providers and consumers, conducted skills workshops on the use of household tools and pocket calculators, as well as just sitting around and talking informally with consumers and service providers; 3) **A Work Setting** — As an overt participant-observer, the researcher has spent considerable time in the work site of several of the group home consumers. During the course of the research, it became apparent that the work setting was an important social setting related to the normalization experience. The researcher observed service providers and work supervisors in their interaction with consumers in daily work activity. Other field experiences of the researcher include: (a) attending staffings on consumers, (b) participating in a weekly meeting where employees and staff were invited to voice feelings and gripes, and (c) informal discussions with personnel advisors, production managers, work supervisors and workers; (4) **In the "Public Eye"** — Over the course of the preliminary investigation, the researcher befriended four retarded adults and spent time with them in leisurely activities that took them into their community. Through this contact, the researcher became known as "a friend" by the consumers and a "citizen advocate" by the group home operators; 5) **Informal Interviews** — The informal interview has been an important tool in investigation to date. The researcher has interviewed the following people: (a) group home staff, including the executive director, group home coordinator, and maintenance personnel, (b) consumers living in the group home, and (c) production managers, personnel advisors, and work supervisors in the work setting. During the course of the study, the researcher will continue to interview key personnel and consumers as new theme, problems, and working hypotheses develop. People in the general public will also be informally interviewed as the study progresses.

APPLICABILITY: A Current movement in field of mental retardation is deinstitutionalization, one result of which has been the development of community alternatives such as group homes.

The evaluation of community alternatives to date has paid no attention to the details and nuances of the normalization process and their effects on consumers (retarded persons) and their significance to others. In order to demonstrate the success of group home efforts, the direct experience of retarded persons and their adaptation to this translation and change in life-style there must be investigated.

Such knowledge has the possibility of enhancing our learning about important ways to improve the environment of retarded persons so that they may participate more fully in society, contribute as citizens, and, to the extent individually possible, become productive in the economy. In addition, this consumer information has definite implications for pinpointing previously unforeseen problems as they pertain to housing and social barriers. This increased understanding of their experience in "being normalized" has the potential of facilitating and increasing our communication with and understanding of retarded people.

329 Evaluation of Retarded Student Achievement in Career Education Programs

Principal Investigator: **Larry K. Irvin, Ph.D.**
1977
Status: **New**
Dates: **September, 1976-June, 1978**
Cost*: **Annual —** **Projected Total $150,000**
RT Annual — **RT % of Annual Total —**
Annual Report Reference: **#11, Page 170, R-43**
* (Project supported entirely by BEH Grant G007605412)

OBJECTIVES: The primary purpose of this project is to examine the reliability and validity of true/false and multiple-choice formats for testing important student behaviors within career education programs for the mentally retarded. Six specific objectives have been identified.

Reliability of Alternative Test Formats

1. Develop 2-choice and 3-choice orally administered multiple-choice versions of three SPIB tests.
2. Empirically eliminate inappropriate items from the preliminary versions of the 2-choice and 3-choice tests.
3. Prepare revisions of the 2-choice and 3-choice multiple-choice tests.
4. Determine reliabilities of the 2-choice and 3-choice multiple-choice tests, and compare them with the reliabilities of the original true/false tests.

Validity of Alternate Test Formats

5. Develop criterion instruments for determining the validity of the true/false and two multiple-choice versions of each test.
6. Determine the validity of each of the three formats for each test.

METHODOLOGY:

1. **Preliminary Development of Multiple-Choice Formats.** Multiple-choice versions of three of the original nine SPIB tests will be constructed, (using the existing SPIB items as guidelines for content.)
2. **Item Analysis of Preliminary Forms.** Four hundred fifty students from high school EMR classrooms in Oregon, Washington, California, and Texas will be tested on the preliminary version of each multiple-choice test. (Demographic information will also be collected.) Item difficulty levels, option frequencies, and item/test correlations will be calculated for each item.
3. **Revision of Preliminary Forms.** Based upon the results of item analysis, as well as on considerations of content integrity, unsuitable items will be revised or eliminated on each of the three tests.
4. **Reliability of Revised Forms.** Four hundred fifty high school EMR students will again be tested on two-option and three-option multiple-choice forms, as well as on the original true/false form of each of three tests. In order to control for the effects of practice, the order of administering the three forms of each test will be systematically varied. Item difficulty levels and item/test correlations will be calculated for each item within each form of each test, in order to ascertain the impact of item revision. Finally, means, standard deviations, and measures of internal consistency will be determined for each form of each test (and also for subsamples, using the demographic variables as stratifiers.)
5. **Development of Criterion Instruments.** The original SPIB content area structure will be used to construct two criterion instruments for each of the three SPIB tests selected: (1) a rating scale, and (2) an applied performance test of the student competencies implied by each test. These two instruments will be field tested on 100 high school EMR students in Oregon, internal consistency reliabilities will be calculated, and any necessary revisions will be made.
6. **Validity of Alternate Forms.** Both criterion instruments for each of the three tests will be administered to 150 students. Since administration of the battery will require between five and six hours for each student, no more than five students from any given classroom will be selected. Nine separate multiple regression analyses will be produced, one for each of the three forms of

each of the three SPIB tests. Trends indicating the superior validity of a test format will be examined and subjected to further analyses.

FINDINGS TO DATE: Negotiations for samples were completed; the first-year sample includes approximately 650 potential participants in 45 classrooms in 15 school districts. First-year instrumentation has been completed, in collaboration with high school teacher (expert) reviewers. Initial pilot testing of the 3-choice forms of all three tests has been completed on approximately 350 students. Criterion instrument development is continuing.

APPLICABILITY: There is a large user population for assessment instruments and strategies for career education programs for mildly retarded citizens. Educators and vocational rehabilitation professionals consistently voice needs for appropriate measurement tools. Effective programming and placement decisions can result only from precise measurement strategies that are designed to assess specific program components. By exploring test formats that may be appropriate for student evaluation in career education programs, this project can leave us with a measurement strategy that can be used appropriately by all who are involved in the education and vocational rehabilitation of mildly retarded citizens.

DEAFNESS
RESEARCH
& TRAINING
CENTER

New York University (RT-17)
Deafness Rehabilitation Research and Training Center

CORE PROBLEM

Improving the Delivery of Services to Deaf People

CORE AREAS

Developing Models for Service Delivery

Studies to determine the systems which most effectively and efficiently deliver services to deaf people.

Developing the Data Base

Studies to gain accurate information on the demographic characteristics of the deaf population, necessary for effective planning and delivery of social and rehabilitation services.

Communication Research

Studies on proximal (face-to-face) communication and telecommunication (communication at a distance) with deaf persons.

Vocational Research and Development

Examination and development of work evaluation practices with deaf persons; studies to determine what factors of specific occupations militate against the employment and promotion of deaf workers, with the aim of eradicating the barriers; research and development of new occupations for deaf workers.

Deaf Community Development

Research and training projects designed to bring deaf consumers into more active and constructive roles in planning and delivery services to the deaf community

Personnel Research and Development

Examination of techniques to expand the reach of existing professionals to greater numbers of deaf clients and to facilitate the preparation of new personnel.

NEW YORK UNIVERSITY DEAFNESS CENTER

Jerome D. Schein, Ph.D., Director
New York University Deafness
Rehabilitation Research and Training Center
80 Washington Square East
New York, New York 10003

PROJECT TITLES BY FY 1977 STATUS

COMPLETED

ABSTRACT NO.

Development of Standards and Principles for Visual Displays for Deaf Persons. The Visual Communication Laboratory (Alan Stewart, Ph.D.) 330

Continuing Assessment of Programs for Preparation of Professionals to Work with Deaf People (Jerome D. Schein, Ph.D.) 331

A Model Casefinding, Counseling and Referral Program for Deaf People (Douglas Watson, Ph.D.) 332

Deaf Community Development (Douglas Watson, Ph.D.) 333

The Development and Application of New Testing Procedures to the Study of Captions and Sign Language on Television (Alan L. Stewart, Ph.D.) 334

Supplemental Security Income and the Deaf Community (Jerome D. Schein, Ph.D.) 335

Determining the Feasibility of A National Cooperative for the Development and Distribution of VR Telecommunications Programming (Jerome D. Schein, Ph.D.) 336

Implementation of the Model State Plan for Vocational Rehabilitation of Deaf Clients (Jerome D. Schein, Ph.D.) 337

Assessment of the Social Service Needs of Deaf People in Connecticut (Jerome D. Schein, Ph.D.) 338

Learning Strategies in Deaf and Hearing Adults (Jerome D. Schein, Ph.D.) 339

Variables Related to the Attainment of Occupational Status Among Deaf Adults (John G. Schroedel, M.A.) 340

Model State Plan Inventory (Jerome D. Schein, Ph.D.) 341

CONTINUING

Service Delivery Model for Deaf Inner City Residents (Douglas Watson, Ph.D.) 342

Overcoming Barriers to Deaf Persons in Federal Government (Jerome D. Schein, Ph.D.) 343

Development of Videotapes for Application in Training Rehabilitation Counselors to Work with Deaf Clients (Thomas Freebairn, Ed.M.) 344

National Interpreter Training Consortium (Jerome D. Schein, Ph.D.) 345

NEW

Cost Analysis of the Rehabilitation of Severely Disabled Deaf Clients (Jerome D. Schein, Ph.D.) 346

CONCLUDED 1976

Demonstration of a Cable Television Cooperative (Thomas Freebairn, Ed.M.)

International Survey of Deafness (Jerome D. Schein, Ph.D.)

CONCLUDED 1977

Career Development for Non-College-Bound Deaf People (Concluded prematurely due to lack of funds) (Glenn Lloyd, Ed.D.)

OTHER

Career Development for Deaf People: Nonverbal Communication Specialist (Approved pending funds) (Glenn T. Lloyd, Ed.D.)

330 Development of Standards and Principles for Visual Displays for Deaf Persons. The Visual Communication Laboratory

Principal Investigator:	Alan Stewart, Ph.D.	
FY 1976		
Status:	Continuing	
Dates:	September, 1971-August, 1977	
Cost:	Annual $55,900 RT Annual $34,040	Projected Total $257,000 RT % of Annual Total 61%
Annual Report Reference:	#9, Page 13, R-5	
FY 1977		
Status:	**Completed**	
Dates:	**September, 1971-June, 1976**	
Cost:	**Annual $50,900** **RT Annual $34,040**	**Projected Total $200,000** **RT % of Annual Total 67%**
Annual Report Reference:	**#10, Page 11, R-5**	

OBJECTIVES:

1. To design legible and efficient displays of visual information;
2. to promote early visual and cognitive development of deaf children;
3. to discover how a deaf person can best be trained to analyze and use the information available within his visual environment;
4. to document the stages of psychological processing which result in letter and word recognition, and thereby allow a systematic program of reading instruction to be developed specifically for deaf children and remedial programs developed for deaf adults.

METHODOLOGY:

1. The principal experimental approach was to use a fixed ratio of target/mask energy at each luminance level and systematically vary both positive and negative values of stimulus and mask onset.
2. Using a homogeneously illuminated mask under these conditions, indications are that non-monotone functions become monotone as luminance is reduced from 70 to 7 cd/m².
3. In metacontrast studies, similar findings have been made, but subsequent studies showed that increasing mask energy restores monotone changes in performance.
4. A study was conducted to determine if an increase in the luminance or duration of a target letter would decrease target recognition under backward masking by a patterned mask. Comparisons were also made between masking under conditions of light and dark adaptation.
5. In all experimental procedures, well trained psychophysical observers were used.
6. Forced choice psychophysical procedures were used throughout, and all stimuli were presented tachistoscopically.
7. All experimental designs were based on a repeated measures model of analysis of variance.
8. In a comparison of target detectability across a range of 3 log units of illumination, luminance and time factors were crossed in a completely balanced factorial design.
9. If monotone backward masking functions are encountered using a homogeneously illuminated mask, target energy will be fixed at the luminance level resulting in monotone functions and an additional experiment will be fun. In this experiment, mask energy will be increased systematically so as to determine if the masking functions, like metacontrast functions, will become monotone. Recognition studies using alphabetic material will be run under comparable experimental conditions.

FINDINGS TO DATE:

1. The results indicated that under dark adaptation increasing the target luminance or duration will decrease target recognition. It was also found that under light adaptation increasing the target luminance or duration will increase target recognition. The general indication is that target report is best when the target energy is close to the observer's adaptation level.
2. Under adaptation to photopic levels of illumination, however, target report was lowest for targets whose luminance was closest to the observer's adaptation level. Therefore, metacontrast and masking by a patterned mask both show a strong functional similarity.

3. Without a reliable index of visibility, however, it is impossible to anticipate how changing the luminance or time parameters of any visual display will affect the display's legibility.
4. The form which interference effects take is highly sensitive to the range of luminance conditions employed. At about 70 cd/m², backward masking is most pronounced, while at intermediate photopic levels of about 30 cd/m², backward and forward masking interference are about equally pronounced.
5. Determining the optimal level of light adaptation is thus a complex but crucial consideration in eliminating visual fatigue and confusion from dynamic visual displays.

APPLICABILITY: Rehabilitation training for a deaf person must be carried out through some means of visual communication. For training to be effective and efficient, visual information must be precisely tailored to the deaf person's abilities. Early training of deaf children can be accomplished with predictable results once the visual development of children can be systematically evaluated. Visual communication for instructional purposes must be designed so as to minimize factors like visual fatigue and confusion which detract from the effectiveness of training. Thus, results of this study can lead to improved training procedures and more successful rehabilitation for the deaf client.

331 Continuing Assessment of Programs for Preparation of Professionals to Work with Deaf People

Principal Investigator:	Jerome D. Schein, Ph.D.	
FY 1976		
Status:	Continuing	
Dates:	November, 1970-September, 1977	
Cost:	Annual $24,010 RT Annual $16,100	Projected Total $125,000 RT % of Annual Total 67%
Annual Report Reference:	#9, Page 29, R-10	
FY 1977		
Status:	**Completed**	
Dates:	**November, 1970-June, 1976**	
Cost:	**Annual $24,010** **RT Annual $16,100**	**Projected Total $100,000** **RT % of Annual Total 67%**
Annual Report Reference:	**#10, Page 15, R-10**	

OBJECTIVES:

To provide continuous feedback to the Deafness Center training faculty on the strong and weak points in the curriculum.

To determine modifications in the curriculum which may be required by changes in the field.

To obtain projections of the demands for professional personnel.

METHODOLOGY: Since 1971, data have been assembled continuously on two groups: current students and graduates of the program. The Knowledge of Deafness Test and a proficiency test in American Sign Language (Communication Skills Assessment) were developed and administered to current students. Along with the Cowen and Siller Attitudes towards Deafness scales, the test battery was used to determine the knowledge, attitudes and skills of students before and after their training at New York University.

Annually, graduates are sent a mail questionnaire soliciting information about current employment. Evaluations of graduates are also obtained from supervisors.

FINDINGS TO DATE: Data from the assessment were directly applied in a major revision of the Deafness Center's graduate program curricula. As a result of reports from the field that deafness rehabilitation specialists were needed and from students that more specialized and detailed information about deafness was desired, the Deafness Center developed a new program leading to the Master's degree in Deafness Rehabilitation. The Deafness Center is currently assessing first-year results with the new program.

Feedback from former students and their employers led to the following specific innovations in the program: (1) incoming graduate trainees now spend one full week each fall in a sign language retreat to provide a total living-learning environment for rapid acquisition of manual communication skills. Findings to date indicate that the week-long program provides a solid foundation for students, facilitating their further acquisition of signs in regular Deafness Center manual communication classes, increasing their voluntary interaction with deaf people during the time they are students at New York University, and generating confidence in work with deaf people. Pre- and post-tests given regularly at the retreats demonstrate rapid and broad acquisition of signs. The question is now being investigated whether the short, intensive model of sign language instruction may be more helpful to many students than more piecemeal, distributed instruction. (2) Special telelectures have been arranged with nationally recognized authorities in deafness rehabilitation speaking to students on video-tapes. The lecture is followed by a direct two-way telephone hookup allowing students to question and respond to the speaker. This arrangement has proven highly successful in enabling students to come into contact with leaders in the field and to have their questions answered at the highest levels. For the busy administrator, the arrangement permits him to contact students directly without having to waste precious time in travel. (3) The Deafness Center has prepared a competency-based teacher education program in response to requests from the field and from students. The program has met with the approval of the New York State Education Department. (4) State directors of vocational rehabilitation agencies throughout the country have been contacted and requested to anticipate their personnel needs in order to ensure the relevance of the training to current needs in the field.

APPLICABILITY: Staff development at all levels requires evaluation. The instruments and procedures developed in this project can be used by other universities and agencies wishing to assess the capabilities of their staff and/or students in serving deaf people.

The results of the assessment have been applied directly to effect a major improvement in the quality of graduate training offered by the Deafness Center. The findings have been shared with other New York University faculty for their consideration. Reports in **The Deaf American** and other publications are expected to lead to changes in personnel preparation in other universities.

Information on both the Knowledge of Deafness Test and the Communication Skills Assessment has been given to interested training centers. Articles have appeared in professional publications.

332 A Model Casefinding, Counseling and Referral Program for Deaf People

Principal Investigator:	Douglas Watson, Ph.D.	
FY 1976		
Status:	Completed	
Dates:	January, 1972-August, 1975	
Cost:	Annual $59,710 RT Annual $39,445	Projected Total $150,000 RT % of Annual Total 66%
Annual Report Reference:	#9, Page 33, R-20	

OBJECTIVES:

1. To investigate new case finding techniques with deaf people,
2. to develop procedures for increasing the availability of existing rehabilitation services which have potential for assisting deaf clients;
3. to identify the types of problems which deaf people have and with which the community service agencies are unprepared to deal.

METHODOLOGY:

1. The counselor staff will be deployed to target areas to visit organizations for the deaf and establish regular hours in the headquarters for local deaf groups.
2. The unserved deaf population (especially the Black and Puerto Rican deaf groups) will be identified and acquainted with the services already available from local agencies.
3. Information will be collected, analyzed, and disseminated about identified clients, agency problems, client functioning outcomes, estimated costs of services, and modifications in agency procedures.

PROGRESS AND FINDINGS: 334 clients received case services during the project. This does not include 159 clients classified under "brief contacts" who did not receive case services. These brief contacts involved: (a) provision of information on appropriate resources, types of services, eligibility requirements and individuals to contact for assistance; (b) client preparation for referral to other agencies, by providing information on location, procedures for admission or acceptance, current information on program developments, and nature of services provided; (c) consultation with agency staff to assist them in serving deaf clients referred to them.

Data on client service needs indicate that there has been an increase in service requests for the total client population in the following areas: job placement, vocational training and education training. This trend is identified with the changing economic and job market trends: greater unemployment, growth of white collar jobs and decline of various industries, increase in job requirements, and increase in educational programs for deaf adults. As the data indicate, there is a continuing need for traditional rehabilitation services for deaf persons. There is evidence, however, from the experience of the project staff, that social service needs, such as mental health services, legal assistance and public assistance, are pertinent, but resources for such needs are not as well developed as rehabilitation facilities. As such programs expand and become more effective, the demands for such services will increase.

A resource file has been developed and field tested by the project staff and other service programs. The need for this type of resource information is evident in view of the fact that 22.5% of the project referrals were from community service agencies for the general population. These agencies were unable to effectively assist deaf clients in obtaining the services they needed. In one facility in which the resource file was field tested, it was found that the staff's access to such information expedited services to deaf clients.

Several conferences have been conducted with selected deaf leaders and consumers, particularly those of ethnic minority group background, to assist them in identifying their service needs.

A number of areas have been identified as essential to a community based service delivery program for deaf persons. These include: (1) use and continuous updating of a resource file, (2) provision of support services to community agencies, (3) maintenance of communication channels with deaf community organizations, (4) establishments of provisions in service agencies' budgets for the cost of interpreter services.

Two articles have been published. "Rehabilitation with Deaf People: Four Models for Facilitating Service Delivery." **Rehabilitation Literature,** Vol. 36, No. 2, February, 1975. "A New Approach to Serving Deaf People." **Social and Rehabilitation Record,** January, 1975.

APPLICABILITY: This program should result in immediate benefit to deaf clients through direct improvements in delivery systems and by increasing the awareness of deaf people regarding agency services and limitations.

333 Deaf Community Development

Principal Investigator:	Douglas Watson, Ph.D.	
FY 1976		
Status:	Continuing	
Dates:	April, 1972-August, 1976	
Cost:	Annual $23,150 RT Annual $15,750	Projected Total $70,000 RT % of Annual Total 68%
Annual Report Reference:	#9, Page 53, R-25	
FY 1977		
Status:	**Completed**	
Dates:	**April, 1972-May, 1976**	
Cost:	**Annual $23,150** **RT Annual $15,750**	**Projected Total $70,000** **RT % of Annual Total 68%**
Annual Report Reference:	**#10, Page 19, R-25**	

OBJECTIVES:

To develop improved participation by deaf consumers of social and rehabilitation services.

To provide leadership training for deaf community members, especially ethnic minority group members.

METHODOLOGY: Four sets of meetings were held: (1) Goal development seminars for leaders of the Empire State Association of the Deaf, (2) A statewide workshop involving twelve organizations of and for deaf people to identify common goals and promote cooperation, (3) Leadership training seminars for ethnic minority deaf leaders, and (4) Consumer education workshops for deaf people in New York City.

PROGRESS AND FINDINGS: A series of seminars was held with 15 selected leaders of the Empire State Association of the Deaf to assist the organization to identify its own goals and strategies. Goals set by the ESAD which have been targeted for action this year include a membership drive, improved public relations program, greater influence upon the State's Commission to Study the Problems of the Deaf, and internal reorganizations.

Assistance was provided to ESAD and eleven other organizations at a statewide coalition meeting held in Syracuse, New York. Deafness Center staff helped in the organization of the conference, presented papers, and assisted in the follow up activities. The coalition of organizations resulting from this conference is beginning to have a major influence in informing the New York State Office of Vocational Rehabilitation about current needs of deaf people.

Training seminars held Saturdays at New York University for ethnic minority deaf leaders produced strategies for increasing their influence among the deaf and general communities.

APPLICABILITY: Leadership and organization of the deaf community require development at all levels. The procedures developed are applicable to other communities.

334 The Development and Application of New Testing Procedures to the Study of Captions and Sign Language on Television

Principal Investigator:	Alan L. Stewart, Ph.D.	
FY 1976		
Status:	Continuing	
Dates:	June, 1973-September, 1976	
Cost:	Annual $19,800 RT Annual $42,500	Projected Total $150,000 RT % of Annual Total 72%
Annual Report Reference:	#9, Page 61, R-28	
FY 1977		
Status:	**Completed**	
Dates:	**June, 1973-September, 1976**	
Cost:	**Annual $59,000** **RT Annual $42,500**	**Projected Total $150,000** **RT % of Annual Total 72%**
Annual Report Reference:	**#10, Page 27, R-28**	

OBJECTIVES:

1. To discover the best ways in which fingerspelling can be displayed on television;
2. To investigate the effect of camera angle on the intelligibility of fingerspelled letters;
3. To investigate the effect of the length of the string of fingerspelled letters on the viewer's ability to detect and identify individual letters within a sequence.
4. To provide the information necessary to make an informed decision as to whether captioning material for deaf audiences is best done by means of fingerspelling, sign language, printed captions, or some combination of these methods.
5. To investigate the existence and nature of individual differences in the short-term recall of fingerspelled letters, and of linguistic correlates of these differences; to examine the extent to which fingerspelled and printed captions are interchangeable in their usefulness to deaf viewers differing in cognitive attributes.

METHODOLOGY:

1. For each of the following studies, the data in the form of percent correct report of letters were submitted to repeated measures analysis of variance. For all studies, stimuli were strings of 3 or 6 randomly selected letters delivered at an average rate of approximately 300 msec/letter. These were fingerspelled at an angle of 45° to the camera except for the study in which angle of regard was an independent variable. In all studies, videotapes were shown to deaf adult viewers under standard conditions.
2. The viewer's ability to report the elements of strings of 3 as opposed to 6 letters was first compared. In the longer strings, the percent correct letters reported declined as a function of the letter's serial position. There was no consistent decline with serial position in the shorter strings, i.e. the second and

third letters tended to be reported with the same accuracy as first letters in 3 letter strings. The differential effect of serial position according to length of strings recurred when angle of regard was varied. On the other hand, four angles of regard (full face, 30°, 60° and 90°) seemed to permit about equivalent mean accuracy of report.

3. In a separate experiment, the duration of intervals between the letters in a six letter string was varied. The serial position effect was alleviated as interval duration approached one letter/second and had completely disappeared at intervals of one letter/2 seconds.
4. In a fourth experiment, serial position effects were examined for 3 and 6 letter strings delivered at 300 msec/letter in an unnaturally even tempo; with 6 letter strings, serial position was associated with a monotonic decrease in accuracy of report. This was compared with the report of 6 letter strings delivered at a natural, uneven tempo which averaged about 300 msec/letter. A decrease in accuracy with serial position was again recorded except for a modest increase for the final serial positions. This application of the presentation speed and serial position results of the first two studies in our series indicated that the slight improvement in report of letters in the final positions of strings delivered at an uneven tempo within the strings.
5. In an additional set of experiments, the relationship of performance on two linguistic tasks was evaluated by means of a discriminant analysis. One task required recognition of strings of 6 randomly selected fingerspelled letters delivered at rapid-normal, intermediate, and slow rates of presentation; the dependent measure again was percent correct letter recognition. In another task, the dependent measure was reaction time (RT) in indicating matches among four types of printed letter pairs: Physical matches and mismatches, for example **A A** and **A B;** nominal matches and mismatches, for example **A a** and **A b.**

PROGRESS AND FINDINGS:

1. Angle of regard is a less important variable in the legibility of fingerspelling on television than was initially hypothesized.
2. A letter's serial position within a sequence of fingerspelled letters is highly important. There are systematic decrements in percent correct reports of letters as their positions become further removed from the initial letter of a sequence. When intervals between exposure of letters within a sequence were systematically varied, it was found that serial position effects nearly disappeared at a presentation rate of one letter/second and were completely eradicated at one letter/two seconds.
3. Serial position and tempo effects were not evidenced with sequences of only three letters.
4. The declining monotonic functions associated with serial position in the longer strings are similar to those found in some visual masking studies. However, in the present study, when masking effects were experimentally controlled, these declining monotone functions were still obtained.
5. Observers divided themselves into two groups in their performance on the fingerspelling and printed letter-matching tasks. Monotone serial position curves in the recognition of fingerspelled letters delivered at an intermediate rate were associated with faster RTs, on the printed letter-matching tasks, to both types of matches, with a larger difference in RT between physical as opposed to name matches. Bow-shaped serial positive curves were associated with slower RTs to printed letter matches and little difference in reaction time to the two types of matches. Thus, cognitive characteristics of the viewer were found to interact with a fingerspelled letter's serial position and presentation rate, in their effect on letter recognition.

APPLICABILITY: The results of this study have immediate relevance to the improvement of televised fingerspelled and printed captions. It would seem that accomplishment of this goal will require special attention not only to certain parameters of the physical signal but to the cognitive abilities and styles of specific groups of deaf viewers as well.

335 Supplemental Security Income and the Deaf Community

Principal Investigator:	Jerome D. Schein, Ph.D.	
FY 1976		
Status:	Completed	
Dates:	January, 1974-June, 1975	
Cost:	Annual $7,820 RT Annual $5,520	Projected Total $7,820 RT % of Annual Total 71%
Annual Report Reference:	#9, Page 78, R-34	

OBJECTIVES:

1. To inform deaf people of their potential eligibility for SSI payments,
2. to see that adequate interpreting services are provided for deaf SSI applicants;
3. to obtain clarification of the eligibility of deaf persons for SSI.

METHODOLOGY:

1. To inform deaf persons about the SSI program, articles were written for various journals. The Deafness Center also cooperated with Social Security Administration in an attempt to obtain a pamphlet that would be understood by deaf readers. The effort continues.
2. A survey was designed to gather cogent data on current status of SSI among poverty-level deaf persons.
3. Meetings were held with Social Security Administration officials at federal, regional and local levels.

FINDINGS TO DATE: Articles outlining the SSI program and announcing the Deafness Center's interest in assisting deaf SSI applicants were printed in both **The Deaf American** (December, 1974) and **The Silent News** (January, 1975). A number of local deaf community newsletters **(The Wichita Whisper, Milwaukee Chapter Chatter, The Jayhawk News, D.C. Eyes, Florida Association of the Deaf Newsletter)** reprinted the article. Since the project began, 34 persons have written to the Deafness Center about their specific difficulties in obtaining SSI benefits, a sample of 51 deaf individuals has been surveyed about experiences with the SSI program, and numerous telephone case consultations have been provided to local Social Security offices at their request.

APPLICABILITY: Because of communication problems, deaf people are at a disadvantage in applying for and obtaining special benefits such as SSI. A national program demonstrating the difficulties deaf persons have in securing what is their due and illustrating ways to overcome communication problems should help to make several agencies more responsive and sensitive to the needs of the deaf community.

336 Determining the Feasibility of A National Cooperative for the Development and Distribution of VR Telecommunications Programming

Principal Investigator:	Jerome D. Schein, Ph.D.	
FY 1976		
Status:	New	
Dates:	June, 1974-August, 1975	
Cost:	Annual $34,400 RT Annual $30,000	Projected Total $34,400 RT % of Annual Total 87%
Annual Report Reference:	#9, Page 98, R-36	
FY 1977		
Status:	**Completed**	
Dates:	**June, 1974-December, 1975**	
Cost:	**Annual $934,400** **RT Annual $30,000**	**Projected Total $934,400** **RT % of Annual Total 3%**
Annual Report Reference:	**#10, Page 45, R-36**	

OBJECTIVES:

1. To determine the feasibility of a national cooperative for the exchange of VR program materials.
2. To compare the alternative formats for such program materials.
3. To establish the parameters of such a cooperative preliminary to obtaining funding for it.

METHODOLOGY: The project is divided roughly into three sections.

1. **Preparation of a Feasibility Study Report.** This involves identifying existing hardware resources, identifying existing software resources, defining production and distribution tasks, defining alternative funding arrangements, defining the roles and responsibilities for project agencies and organizations and identifying problem areas.
2. **Planning for Demonstration Projects.** This involves identifying alternative sites, defining production and distribution tasks, defining alternative funding arrangements, defining roles and respon-

sibilities for projected agencies and organizations and identifying problem areas.

3. **Establishment of Transition Task Force.** This involves defining responsibilities for task force, identifying and enlisting states with extensive telecommunications resources, identifying and enlisting states with VR telecommunications activities, and identifying and enlisting appropriate communications experts.

FINDINGS TO DATE:

1. Technical studies documented the size of the major national communications system (television, radio, telephone, etc.) and audio-visual systems; and the uses of these systems by major customers (government, schools, colleges, etc.).
2. Two demonstration projects examined all aspects of planning, producing, and distributing television programming suitable for VR agencies.
3. Surveys of 15 key states were made to determine the extent of telecommunications use by VR agencies, including a week-long on-site visit to Oklahoma by two project staff members.
4. The general conclusions are that major efforts must be made in three areas before a VR programming cooperative becomes feasible. First, appropriate communications equipment (hardware) must be made conveniently available and, when necessary, must be modified for effective use. Second, program materials (software) suitable in format and in content must be made conveniently available. Third, VR clients and VR staff must be trained in the use of the hardware and the accompanying or resulting software.
5. One of the demonstration projects was the development and production of a series of 10 30-minute sign language instruction programs with WNBC-TV. The series was produced at an approximate cost of $900,000 to NBC.

APPLICABILITY: Modern telecommunications technologies have the potential for improving several types of VR service delivery. This project therefore relates directly to two areas of Deafness Center activity — communications research and service delivery research.

337 Implementation of the Model State Plan for Vocational Rehabilitation of Deaf Clients

Principal Investigator:	Jerome D. Schein, Ph.D.	
FY 1976		
Status:	Completed	
Dates:	June, 1974-August, 1975	
Cost:	Annual $14,300 RT Annual $11,800	Projected Total $14,300 RT % of Annual Total 83%
Annual Report References:	#9, Page 109, R-38	

OBJECTIVES:

To develop guidelines for implementation of the Model State Plan for professional and consumer groups.

To respond to objections raised by persons in the field with respect to various points in the MSP.

To outline a program or programs which will lead to implementation of the Model State Plan in every state.

METHODOLOGY: A meeting of the original drafting group of the Model State Plan was called to address four topics:

- —how to motivate states to implement the MSP
- —sources of data for planning and evaluating MSP activities
- —legislation necessary to or desirable for MSP implementation
- —professional and consumer involvement in the MSP

FINDINGS TO DATE: The group concluded that various actions were required to further the MSP. These included meetings with CSAVR's Committee on Deafness, development of an inventory to assess extent of MSP implementation in each of the states, and preparation of a report.

A meeting was held with the CSAVR Committee on Deafness. The Committee agreed to address a letter to RSA Central Office outlining the recommendations contained in the MSP. The Committee also reviewed the MSP inventory developed by the Deafness Center and agreed to submit it to CSAVR's research and administrative committees, so that the request to have it completed would have the full weight of CSAVR behind it. The Deafness Center was asked, and agreed, to analyze the results of the inventory. Target dates for mailing and completing the survey were September and November, 1975 (See project entitled "Model State Plan Inventory".)

APPLICABILITY: Fundamental to increasing rehabilitation of deaf clients is the state plan. The MSP provides exemplars for the state VR agencies. By considering the basic provisions outlined in the MSP, state VR planning may be greatly improved. All essentials for an effective program of rehabilitation for deaf clients are discussed and alternative actions presented.

338 Assessment of the Social Service Needs of Deaf People in Connecticut

Principal Investigator:	Jerome D. Schein, Ph.D.	
FY 1976		
Status:	New	
Dates:	May, 1975-July, 1975	
Cost:	Annual $6,160 RT Annual $1,380	Projected Total $6,160 RT % of Annual Total 22%
Annual Report Reference:	#9, Page 131, R-40	
FY 1977		
Status:	**Completed**	
Dates:	**May, 1975-July, 1975**	
Cost:	**Annual $6,160** **RT Annual $1,380**	**Projected Total $6,160** **RT % of Annual Total 22%**
Annual Report Reference:	**#10, Page 53, R-40**	

OBJECTIVES:

To identify and assess the capability of existing resources to meet the needs of deaf Connecticut residents.

To identify gaps in service delivery to deaf persons and to determine alternative means of improving delivery of services.

To identify problems experienced by deaf persons and their families in obtaining services.

To provide planning information which can be used to develop an integrated community system designed to improve delivery of services for deaf residents of Connecticut.

METHODOLOGY: A sample of social service agencies was surveyed to determine nature of services, types of clients served, services provided for deaf persons and number of deaf persons served during the past year. The receptiveness of the agency to initiating or expanding services to deaf persons was also determined.

A representative sample of deaf leaders in Connecticut was surveyed to obtain perceptions of the service needs of deaf persons, the resources available to meet those needs, and the barriers which exist to the utilization by deaf persons of existing service resources in Connecticut.

FINDINGS TO DATE: The surveys have been completed and the results analyzed. Of the 611 questionnaires mailed, 350 or 57% were returned.

Taken together, the survey findings indicated the need for a comprehensive statewide system for delivery of human services to deaf persons and their families. To assist the State agencies to plan, develop, monitor and evaluate a comprehensive service delivery system for its deaf residents, a series of programmatic recommendations was submitted. It was suggested that the state:

1. Develop and maintain a statewide registry of deaf and hearing impaired residents.
2. Develop and maintain a statewide record of state and public social service contacts with deaf residents.
3. Provide ongoing technical assistance to state and local community programs engaged in service to deaf persons.
4. Advise social service agencies in the state of major gaps and duplications in services to deaf persons and their families.
5. Develop and maintain a coordinated statewide system for delivery of services to deaf residents, including seven regional outreach stations in the various geographical clusters in the state.
6. Coordinate and monitor programming of various state agencies in service to deaf residents.

7. Establish outreach and information programs to inform various deaf consumer groups about available services.
8. Actively advocate as well as assist general community agencies to plan, develop and operate service programs for deaf persons, including assistance in obtaining additional funding, if indicated.
9. Commission on Deafness should expand its current interpreting services program to accommodate the anticipated increase in demand as general community services become active service providers for deaf residents.
10. Encourage and assist general community service providers with frequent deaf client contacts to obtain manual communication skill training as well as information, knowledge and skills in service to deaf persons.

APPLICABILITY: Improving delivery of community social services to deaf persons enhances and supplements rehabilitation efforts. The comprehensive profile of existing services for deaf persons can be related to the perceived service needs as experienced by these persons. Planning information regarding prevailing service practices is essential to developing a more effective service-delivery system.

339 Learning Strategies of Deaf and Hearing Adults

Principal Investigator:	Jerome D. Schein, Ph.D.	
FY 1976		
Status:	New	
Dates:	June, 1975-May 1976	
Cost:	Annual $20,000	Projected Total –
	RT Annual $12,900	RT % of Annual Total 64%
Annual Report Reference:	#9, Page 142, R-43	
FY 1977		
Status:	**Completed**	
Dates:	**June, 1975-May, 1976**	
Cost:	**Annual $14,300**	**Projected Total $14,300**
	RT Annual $9,145	**RT % of Annual Total 64%**
Annual Report Reference:	**#10, Page 57, R-43**	

OBJECTIVES:

To determine how deaf and hearing adults may differ in handling verbal information.

To design and implement an effective means of presenting signs unambiguously on videotape and film.

To document learning strategies used by deaf individuals when processing signed verbal information.

METHODOLOGY: Twenty-four prelingually deaf and 24 normally hearing adults who sign were selected from lists of signing college graduates in the New York metropolitan area. Each subject viewed 36 pairs of signs, and when presented with the first member of each pair, attempted to write the English equivalent of the second member of that pair. Twelve pairs were related visually, 12 were related semantically, and 12 were related phonologically.

FINDINGS TO DATE: Deaf and hearing participants differed, as hypothesized, in their relative performances with signed paired-associate items. These findings are consistent with a mediational interpretation of the coding process, in which people are considered to select aspects of stimuli meaningful to them, transform these stimuli as needed to facilitate acquisition and recall, and respond in accordance with the codes used.

Prelingually deaf individuals who sign were shown to differ on this task from normally hearing participants. Extrapolating from these findings, the suggestion may be made that prelingually deaf adults may be particularly sensitive to visual arrangements that help them organize and recall information.

For example, demonstration — as opposed to mere exhortation or explanation — may prove effective in teaching deaf clients how to operate machinery, traverse subway routes, and construct products. The key idea seems to be to illustrate or establish visual similarities and relationships in the information to be learned.

APPLICABILITY: Increased understanding of how deaf people learn has important implications for improving rehabilitation efforts with deaf clients. The study has bearing upon communication with deaf clients, how deaf clients assimilate information while undergoing rehabilitation, and how rehabilitative strategies might be improved with deaf clients.

Also, sign language instruction is becoming more widely available to rehabilitation workers. Understanding how hearing people handle signs may lead to improvements in sign language instruction, and subsequently to improved communication between rehabilitation personnel and deaf clients.

340 Variables Related to the Attainment of Occupational Status Among Deaf Adults

Principal Investigator:	John G. Schroedel, M.A.	
FY 1976		
Status:	New	
Dates:	March, 1975-May, 1976	
Cost:	Annual $21,100 RT Annual $14,000	Projected Total $21,100 RT % of Annual Total 66%
Annual Report Reference:	#9, Page 145, R-44	
Principal Investigator:	**Jerome D. Schein, Ph.D.**	
FY 1977		
Status:	**Completed**	
Dates:	**March, 1975-June, 1976**	
Cost:	**Annual $7,000** **RT Annual $2,300**	**Projected Total $7,000** **RT % of Annual Total 33%**
Annual Report Reference:	**#10, Page 60, R-44**	

OBJECTIVES: The purpose of this study was to determine the relationships and assess the implications of variables associated with patterns of social mobility among deaf Americans. The four specific goals of this project were: (1) Assess how parental social class relates to occupational status of the deaf adult. (2) Assess how demographic variables such as respondent's level of education, age, race, and sex relate to occupational status of the deaf adult. (3) Assess how communication skills such as speech and sign language relate to occupational status of the deaf adult. (4) Assess how deafness-related statuses, such as type of special schooling, use of a hearing aid, or parental hearing ability relate to occupational status of the deaf adult.

METHODOLOGY: This study analyzed information in the data bank of the 1972 National Census of the Deaf Population. NCDP data was also compared with intergenerational mobility data from the general population from a 1972 study done by Duncan's research group at the University of Wisconsin Center for Demography and Ecology. Stepwise multiple regression treatments were performed with NCDP data to identify key variables predicting the attainment of occupational status by deaf workers. NCDP data included information on 1,067 deaf adults employed in 1972. 70 cross-tabulations were constructed as were prototype path analysis models to evaluate relationships between variables.

FINDINGS TO DATE: Results of this study were reported in: Schroedel, John G. **Variables related to the attainment of occupational status among deaf adults.** Unpublished doctoral dissertation, New York University, 1976.

MAJOR FINDINGS INCLUDED:

1. **Intergenerational mobility** (deaf respondents compared to fathers). Deaf workers as a group at best have been occupationally stabled during a period (1921-1971) in which hearing workers as a group have been upward mobile. Mean status of occupations for deaf workers in 1972 equal the mean occupational status for the general population in 1950. One third of deaf employees are upward, one third are downward, and one third are stable in mobility attainment compared to their fathers. Deaf workers with deaf parents made significant gains in mobility while deaf workers with

hearing parents tended to be immobile. The more modest the inherited social class of deaf wage earners the larger are prospects for upward mobility. Respondent's present occupation indicates the degree of their social mobility: 60 percent of deaf workers in white-collar jobs had fathers with lower-status jobs; 75 percent of deaf nonfarm laborers had fathers with higher-status occupations.

2. **Intragenerational mobility** (between deaf respondents by age): Deaf workers aged 35 to 65 lag in occupational status behind similar-aged workers in the general population. Deaf employees aged 25 to 34 cut this gap in half compared to same-aged workers who hear. Within the deaf population aged 25 to 65, there are increasing proportions of young deaf workers in white-collar jobs and decreasing proportions in blue-collar jobs. Deaf females have a higher mean occupational status than deaf males, which is also a pattern evident in the general population. Young deaf females enter the labor force through jobs higher in status than young deaf male workers.
3. **Variables important to attainment job status:** Among 21 predictor variables assessed, education is the most important variable in the acquisition of occupational status by deaf workers. Deaf workers are not keeping pace with hearing workers in converting educational achievement into occupational achievement; deaf workers need up to two years additional schooling to obtain jobs equal in status to hearing workers. Parental social class relates to type of communication used by parents with their deaf children, type of school attended, and respondent's level of attained education and occupational attainment. Analyses determined that age at onset of deafness related to respondent's oral skill, with both of these characteristics then affecting highest grade of schooling completed, then onset, speech skill and level of education combining to effect occupational status of the deaf worker.

APPLICABILITY: This research can aid in the development of **assessment instruments** to predict educational and occupational attainment among deaf persons. Project results will be valuable to **planners** of future education and occupational training programs for deaf people. Rehabilitation **counselors** and other professionals serving deaf persons can benefit from project results to identify characteristics in deaf clients related to achievement. This study is believed to be the first of its kind in analysis of occupational mobility of deaf persons.

341 Model State Plan Inventory

Principal Investigator:	**Jerome D. Schein, Ph.D.**	
FY 1977		
Status:	**New & Completed**	
Dates:	**July, 1975–June, 1976**	
Cost:	**Annual $18,825** **RT Annual $12,493**	**Projected Total $18,825** **RT % of Annual Total 67%**
Annual Report Reference:	**#10, Page 70, R-47**	

OBJECTIVES:

To determine State VR objectives in serving deaf clients, including those who are severely handicapped.

To identify problems State VR agencies encounter in establishing and administering services to deaf clients.

To compare the various State VR programs for deaf clients, including definitions used, outreach procedures, intake, diagnosis, determination of eligibility, training, counseling, placement, and follow-up.

To describe manpower needs of State VR agencies with respect to services to deaf clients.

To study State VR use of advisory committees on deafness, channels of interagency cooperation, and special facilities for deaf clients.

METHODOLOGY: The Model State Plan Inventory was a comprehensive survey of State VR plans and programs with respect to deaf clients. The data-collection instrument was approved by the CSAVR Research Committee and mailed to all 50 directors of State Vocational Rehabilitation Agencies as well as heads of VR programs in the District of Columbia, Puerto Rico, Virgin Islands and Guam. A 100% response rate was achieved.

FINDINGS TO DATE: The most important single finding was that a revision of the Model State Plan is required. While the original MSP provided **minimal** standards, it is clear from the results of the survey that the standards are more often viewed as **optimal.** Half the directors, for example, reported having inadequate or nonexistent evaluation facilities for deaf clients. Large numbers of directors expressed needs for assistance in counseling, placement and manpower development. Fewer than half reported having a State Advisory Committee on Deafness. More than half said their states had no suitable facilities for treatment of emotionally disturbed deaf individuals. About 50% reported poor or nonexistent deaf-consumer organizations in their states.

The Deafness Center has prepared a revision of the Model State Plan to make it more directly applicable and helpful to state VR directors.

APPLICABILITY: State VR directors report using the results of this study to improve services to deaf people. The findings have also been used to revise the MSP to produce a more up-to-date and responsive document that will lead to further improvements in deafness rehabilitation.

342 Service Delivery Model for Deaf Inner City Residents

Principal Investigator:	Douglas Watson, Ph.D.	
FY 1976		
Status:	Continuing	
Dates:	July, 1974-June, 1975	
Cost:	Annual – RT Annual –	Projected Total – RT % of Annual Total –
Annual Report Reference:	#9, Page 50, R-23	
FY 1977 Status:	**Completed — No Report**	

OBJECTIVES:

1. To develop and test casefinding techniques that will facilitate the identification of inner city residents who are deaf and help determine the rate of deafness among ethnic minority groups living in the inner city;
2. to identify the problems of these deaf individuals and determine associated needs that relate to their disability;
3. to identify and assess the capability of existing resources to meet the needs of the above population;
4. to develop a model for an integrated community system of services designed to provide rehabilitative services for deaf persons living in inner city situations;
5. to reduce the amount of poverty and welfare assistance among deaf minorities.

METHODOLOGY:

1. The size and characteristics of the ethnic minority group deaf population in New York City will be determined.
2. The existing resources for services to this population will be assessed.
3. A model will be developed for services to this population.
4. The cooperation of existing agencies in the project will be enlisted.
5. The model program of integrated community services will be implemented and evaluation will be undertaken.

PROGRESS AND FINDINGS: This project was originally funded by a supplemental grant but has now received separate funding.

For details of project results, please see the report on projects R-20 "A Model Casefinding, Counseling and Referral Program for Deaf People."

APPLICABILITY: The findings of this project will be used to improve rehabilitation service delivery to deaf clients of low socioeconomic status.

343 Overcoming Barriers to Deaf Persons in Federal Government

Principal Investigator:	Jerome D. Schein, Ph.D.	
FY 1976		
Status:	Continuing	
Dates:	April, 1973-December, 1975	
Cost:	Annual $46,900 RT Annual $32,400	Projected Total $100,000 RT % of Annual Total 84%
Annual Report Reference:	#9, Page 57, R-25	
FY 1977		
Status:	**Continuing**	
Dates:	**April, 1973-August, 1976**	
Cost:	**Annual $15,375** **RT Annual $10,350**	**Projected Total $70,000** **RT % of Annual Total 67%**
Annual Report Reference:	**#10, Page 23, R-26**	

OBJECTIVES:

To improve deaf persons' opportunities to enter and be promoted fairly in federal government.

To develop a training program for supervisory personnel in government installations which will deal with specific problems of, and created by, deaf employees — a program designed to improve occupational conditions for deaf employees.

METHODOLOGY: The Civil Service Commission arranged for a study within two installations. Due to budgetary constraints, only one agency was studied, the Navy Printing Office, Arlington, Virginia.

A sample of jobs was selected, and entrance examinations and job requirements reviewed from the deaf applicant's perspective. Interviews with prospective applicants who are deaf were conducted. Selected occupations were reviewed for possible job tailoring to accommodate deaf workers. Deaf people already employed and their supervisors were interviewed to determine changes which could improve their productivity and job satisfaction.

FINDINGS TO DATE: During the first year of the project relations with the Civil Service Commission and the Navy Printing Office were established, the survey of entrance procedures and job descriptions completed and plans for the study of promotion procedures drawn up.

During the second year, interviews were held with deaf workers, promotion practices were surveyed and orientation to deafness seminars were conducted for supervisors.

During the project's third year activities were curtailed due to budgetary constraints. Recommendations emanating from the survey on entrance procedures are being drafted and will be forwarded to the Civil Service Commission. The survey of job conditions was also completed, with recommendations to be presented to the Civil Service Commission.

The initial pilot project report ("Barriers to the Full Employment of Deaf Persons in Federal Government," **Journal of Rehabilitation of the Deaf,** July, 1975, 1-15) noted that barriers rather than overt discrimination existed. The current project has not changed our perspectives. We remain convinced that appropriate training for supervisors, in conjunction with the guidelines of Section 501 of the Rehabilitation Act of 1973, will go a long way to overcoming barriers to employment and advancement of deaf people in federal government.

APPLICABILITY: The federal government is the largest employer in the nation. Its policies and practices influence industry. Any improvement of deaf persons' opportunities in federal employment should be reflected generally. The federal project also has potential for greater visibility and subsequent influence for good than any comparable local study. In addition, the willingness of the Civil Service Commission to participate in this project will improve the attitudes of the deaf community toward federal employment.

344 Development of Videotapes for Application in Training Rehabilitation Counselors to Work with Deaf Clients

Principal Investigator: Thomas Freebairn, Ed.M.

FY 1976		
Status:	Continuing	
Dates:	September, 1974-August, 1975	
Cost:	Annual $18,420 RT Annual $14,720	Projected Total $18,420 RT % of Annual Total 80%
Annual Report Reference:	#9, Page 67, R-29	
FY 1977		
Status:	**Continuing**	
Dates:	**September, 1974-August, 1976**	
Cost:	**Annual $18,420** **RT Annual $14,720**	**Projected Total $18,420** **RT % of Annual Total 80%**
Annual Report Reference:	**#10, Page 32, R-29**	

OBJECTIVES: To design and produce a series of pilot videotapes of counseling sessions with deaf clients for use in programs which train counselors to work with deaf people.

METHODOLOGY:

1. Variables to be considered as important in the videotapes include interview content (type of problem experienced by client), counselor fluency in the use of manual communication, and level of the client's use of language.
2. Representative counseling interview involving selected examples of client problems, characteristics, and related counselor-client interaction will be simulated on videotape. Due to the possible infringement upon client confidentiality which could occur with videotaping of "live" counseling interviews, professional deaf actors and actresses, or Deafness Center staff will simulate clients.
3. Following development of the script, rehearsals, and editing, a pilot videotape will be made using the staff and facilities of the Deafness Center. It is expected that this approach will permit maximum refinement of the script prior to contracting with a professional studio to make final videotapes in a subsequent future project if funds become available.

FINDINGS TO DATE: Preliminary scripts and introductions have been developed for six proposed videotapes. One 30 minute pilot tape using Deafness Center staff and facilities has been completed. Portions of these materials have been reviewed by the Deafness Center Advisory Board, by students in Deafness Center training programs and by other Deafness Center staff members. The evaluations have all been very enthusiastic, in each case including strong recommendations to develop the materials further and to explore arrangements for producing and distributing them for use by other counselor training programs around the country.

APPLICABILITY: Rehabilitation counselors are the coordinators of rehabilitation services. Consequently, their ability to communicate with and provide effective counseling to deaf clients is a critical aspect of the total rehabilitation program.

The pilot tape and materials are expected to prove especially useful in orientation-to-deafness seminars for rehabilitation counselors, and in classroom work of students in rehabilitation counseling programs at NYU. This application will provide effective field evaluation of the pilot materials. A future project, if funded, would produce the final materials in suitable form (videotape or film) and make the master copies available for duplication and distribution to other training programs.

345 National Interpreter Training Consortium

Principal Investigator:	Jerome D. Schein, Ph.D.	
FY 1976		
Status:	New	
Dates:	June, 1974-December, 1980	
Cost:	Annual $336,900 RT Annual $2,900	Projected Total $2.1 million RT % of Annual Total 1%
Annual Report Reference:	#9, Page 85, R-35	

FY 1977
Status: **Continuing**
Dates: **June, 1974–March, 1980**
Cost: **Annual $260,000** **Projected Total $1,300,000**
RT Annual $2,900 **RT % of Annual Total 1%**
Annual Report Reference: **#10, Page 39, R-35**

OBJECTIVES:

1. To upgrade the skills of persons presently interpreting.
2. To recruit and train as interpreters people who have had little or no previous experience as interpreters.
3. To train a group of interpreters having the special skills necessary to interpret for low-verbal, severely handicapped deaf individuals.
4. To prepare interpreter trainers.
5. To assist state agency personnel and other service workers in understanding the role and function of interpreters and in utilizing available interpreting resources maximally while developing new interpreting resources in each state.
6. To educate deaf people in the utilization of interpreters.

METHODOLOGY:

1. Short term workshops lasting one to fourteen days focusing on ethics, expressive and receptive interpreting skills.
2. Twelve-week programs involving instruction in interpreting and intensive practicum.
3. Two-week workshops including instruction in minimal language skill interpreting, field trips, and practicum.
4. Two-week workshops to teach trainers how to teach interpreting, including how to organize material, instructional techniques, audio-visual materials, evaluation, school and agency relationships, and publicity. The NITC is also working with VR agencies in each state and state Registry of Interpreters for the Deaf chapters to develop interpreter training facilities in each state which will continue to train interpreters when the NITC is finished in 1980.
5. Lectures to VR personnel in each state about the role and function of interpreters. Close contact with State Coordinators Of Services to Deaf Clients to assess the need for interpreters in each state, to inform them of trainees who have completed their training, and for them to refer potential interpreters for training.
6. Workshops and presentations to groups of deaf persons, especially to high school students, informing them of how to best utilize interpreting services.

FINDINGS TO DATE: In the first two years of the NITC more than 10,000 persons have attended upgrading workshops; almost 900 beginners have undergone training; 36 minimal language specialist interpreters have been trained; and 82 trainers have received training. Close to 500 deaf persons have had training in how to use interpreters.

Since the NITC began close to 800 interpreters have been certified by the Registry of Interpreters for the Deaf. In addition a number of others have been independently determined qualified by local VR agencies.

There are presently 42 interpreter coordinating facilities throughout the United States. When the NITC began in 1974 there were only 13 such centers, most of which were operated on an informal basis.

VR personnel in all states have received information about the role of the interpreter in the VR process. Most of this information has gone to staff persons working primarily with deaf clients. Now more emphasis is being placed on orienting general counselors in the use of sign language interpreters.

APPLICABILITY: The National Interpreter Training Consortium provides the basis for a substantial, coordinated, program to fulfill the top priority of the Office of Deafness and Communicative Disorders — to overcome the chronic shortage of interpreters for deaf persons. If this approach continues to be successful, it could be applied to meet other RSA priorities.

346 Cost Analysis of the Rehabilitation of Severely Disabled Deaf Clients

Principal Investigator:	Jerome D. Schein, Ph.D.	
FY 1976		
Status:	New and Completed	
Dates:	July, 1975-June, 1976	
Cost:	Annual $7,900	Projected Total $7,900
	RT Annual $5,350	RT % of Annual Total 68%
Annual Report Reference:	#9, Page 106, R-37	

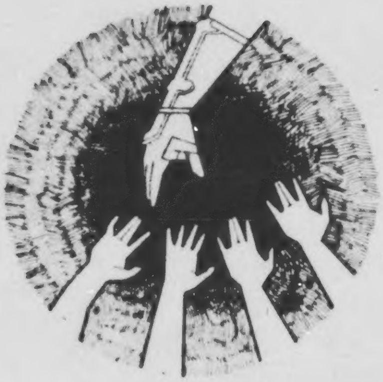
OBJECTIVES: Planning rehabilitation services for severely disabled deaf clients, as specified in the Rehabilitation Act of 1973, requires estimating the costs of these services. Rather than use actual costs, the research will use a more stable indicator: Man-days of service required for a hypothetical "average" severely disabled deaf client, by kind of service and discipline of professional delivering the service. Costs vary from year to year, program to program, and region to region. Man-days, however, should permit more direct comparison of figures and enable predictions concerning costs to be made which will apply over time, program, and geographical region. Each program director can readily convert estimated man-hours required into actual costs for use in planning services. The project aims to survey programs known to have served severely disabled deaf clients in an effort to obtain data on requirements for service delivery with these persons.

METHODOLOGY: A questionnaire has been designed to elicit the information sought. Respondents indicate, by type of service (psychological evaluation, vocational evaluation, personal adjustment training, vocational training, placement and follow-up) and discipline of service worker (project director, psychologist, training instructor, counselor, paraprofessional, placement specialist) the number of man hours required to serve a typical severely handicapped deaf client. Initial and follow-up mailings will be conducted with selected programs across the country. An 80% response rate will be considered satisfactory.

FINDINGS TO DATE: A questionnaire has been designed and pretested with a selected group of experts on serving severely disabled deaf clients.

Further work on the project has been discontinued due to lack of funds.

APPLICABILITY: Serving severely disabled deaf clients may require more time, and cost more, than serving non-severely disabled deaf clients. The current project represents an attempt to estimate these expenditures so that services may be planned which efficiently and effectively make maximum use of available resources in meeting the needs of severely disabled deaf clients.



University of Southern California (RT-18)
Medical Rehabilitation Research and Training Center

CORE AREA

Identifying/Substantiating the Need for Incorporating Comprehensive Rehabilitation Programs into Community Hospital Settings and Effecting the Acceptance/Development of these Programs as an Integral Part of the Rehabilitation System.

Studies undertaken by the Center are aimed at 1) developing a method for early identification of community hospital patients who need services; 2) gaining a knowledge of community hospital systems and sub-systems to serve as an information base with which to plan strategies for implementing comprehensive rehabilitation programs in the hospitals; 3) acquiring a knowledge of the State-Federal rehabilitation program potential for interface with community hospitals, focusing on developing the roles of rehabilitation personnel, the use of the community hospital for physical restoration services, and cost factors influencing the interface; 4) promoting the utilization of rehabilitation research in the treatment and services for community hospital patients; 5) developing and evaluating training programs for hospital and rehabilitation personnel based on research conducted by the Center and appropriate research conducted by others in the field; and 6) developing appropriate reporting methods for disseminating research findings and training tools structured to promote their utilization.

UNIVERSITY OF SOUTHERN CALIFORNIA

Rene Cailliet, M.D., Director
University of Southern California
School of Medicine
Room 102 North Hall
1739 Griffin Avenue
Los Angeles, California 90031

PROJECT TITLE BY FY 1977 STATUS

CONTINUING

	Abstract No.
The Community Hospital as a System (L. Helberg, Ph.D.)	347
Identification of Patients who Need Rehabilitation Services (R. Cailliet, M.D.)	348
Quality Assurance in Rehabilitation (R. Cailliet, M.D.)	349
Exercise Prescription in the Hospital (R. Cailliet, M.D.)	350
State Rehabilitation Agency as a System Serving Community Hospital Patients (L. Helberg, Ph.D.)	351
Survey of the Subsystems in the State Rehabilitation Agency District Office (L. Helberg, Ph.D.)	352

NEW

Medical Information System as a Communication Link: The State Agency Medical Record (L. Helberg, Ph.D.)	353

347 The Community Hospital as a System

Principal Investigator: L. Helberg, Ph.D.
FY 1977
Category: Continuing
Dates: July, 1976-May, 1980
Cost: Annual $29,879 Projected Total $104,637
RT Annual $29,879 RT % of Annual Total 100%
Annual Report Reference: #10, Page 16, R-1.0

OBJECTIVES:

a. To describe the community system and its subsystems.
b. To compare this description with selected hospitals in the region that are identified as community hospitals to test the usefulness of the model and to identify the ways in which an individual hospital deviates from the model.
c. To identify patients who need rehabilitation and describe those needs.
d. To use the descriptive information to devise and test strategies for change to meet those needs by simulation of other methods via pilot studies using cost-effectiveness, cost benefits, and feasibility as criteria.
e. To identify the undesirable effects upon rehabilitation services of current policies or planned procedures in community hospitals.

METHODOLOGY:

a. Literature review will be conducted in the areas of hospital administration, nursing, public health policy and legislation, health care organization, vocational rehabilitation in hospitals, medical social work and related areas.
b. Interviews with and observation of hospital personnel, related agency personnel, and members of the USC faculty will be conducted to provide additional detailed information.
c. Patient data will be acquired from hospitals and from centers handling large numbers of hospital patient abstracts.
d. A description of the hospital structure will be developed.
e. A hospital process description will be developed in terms of the administration-supervision, admission, nursing and daily living care, diagnosis, treatment, ancillary services, discharge and record-keeping activities as interrelated processes; this will also include external systems impacting the hospital, such as PSROs and HSAs, unions, third-party payers, state/local health departments.

FINDINGS TO DATE:

1. A literature review related to the community hospital as a system, underway for the past year, has encompassed the evolution of the hospital, internal processes, linkages of hospitals and health agencies in continued aftercare, quality assurance programs, and organization development within the hospital.
2. RT-18 as part of this study conducted many interviews with hospital staff, health agency personnel, and other related experts; in addition, hospital and other agency processes have been observed directly.

APPLICABILITY: The knowledge gained in this project is to be used as the basis for planning strategies for fostering more modes of comprehensive rehabilitation. These strategies will be tested in later stages of the program. Strategies or other knowledge derived from these findings will be offered to rehabilitation agencies as alternative approaches. RT-18 does not expect to be a decision maker organization for others. Instead the mission is conceived as that of a change-agent consultant role.

348 Identification of Patients who Need Rehabilitation Services

Principal Investigator:	**R. Caillet, M.D.**	
FY 1977		
Status:	**Continuing**	
Dates:	**July, 1976-May, 1978**	
Cost:	**Annual $23,312** **RT Annual $20,122**	**Projected Total $34,000** **RT % of Annual Total 86.3%**
Annual Report Reference:	**#10, Page 30, R-1.1**	

OBJECTIVES:

1. To identify and describe the population in the hospital considered to be potential rehabilitation clients.
2. To acquire a baseline set of data on hospital patients and vocational rehabilitation clients against which to measure changes that occur in the future.

METHODOLOGY:

1. Visit hospitals and individuals involved in patient data collection, and consult with State rehabilitation agency personnel regarding available data. Also, review and analyze national patient data bases for indicators of the size and characteristics of the population of patients needing rehabilitation due to disability.
2. Hold a one-day conference to bring together researchers, data collection experts and medical and rehabilitation personnel to design a baseline study that would exploit all known data resources for the best development of the program.
3. The RT-18 staff will carry out the plan devised at the conference, going back to individual consultants for guidance as problems may arise. The plan implementation (data collection) will require approximately 6 months.
4. The participants in the initial conference will review and criticize accomplishments of the study at a second session and offer suggestions for improvements and methods for using data not previously discussed.
5. RT-18 staff will carry out suggestions received in the second review conference and prepare a report of the project.
6. The next stage in this process will be a study of a population of patients and the data that must be recorded to be able to identify those with needs for rehabilitation services. The first study of available data will provide the knowledge for developing this second study.

FINDINGS TO DATE: The major activity on this project has been the review of available data about hospital patients and rehabilitation clients for baseline and comparison purposes. These data include aggregate figures for the nation from a variety of Federal agencies, including the National Center for Health Statistics, Social Security Administration, and the Rehabilitation Services Administration.

APPLICABILITY: The findings of this study could reveal gaps between available services and those hospital patients with strong potential for using those services. Both of these kinds of information could have policy and program implications in the area of planning and delivery of services.

349 Quality Assurance in Rehabilitation

Principal Investigator:	**R. Caillet, M.D.**	
FY 1977		
Status:	**Continuing**	
Dates:	**February, 1977-May, 1979**	
Cost:	**Annual $31,088** **RT Annual $22,115**	**Projected Total $73,000** **RT % of Annual Total 71%**
Annual Report Reference:	**#10, Page 49, R-1.2**	

OBJECTIVES:

a. To document the development of a quality assurance program constructed by and for the staff of a rehabilitative medicine department using the LAC-USC Medical Center Department of Rehabilitation Medicine as a laboratory.

b. To develop guidelines and expertise for consultation with a community hospital rehabilitation department in the development of a quality assurance program.

c. To develop an objective means of measuring the quality of referrals to a rehabilitation department.

d. To design methods of feedback to referral sources that increase the effective use of the department's services.

METHODOLOGY:

a. The program idea will be presented to the staff of the LAC-USC Department of Rehabilitation Medicine at staff meetings for three months prior to the planned launching of the program to allow for the development of staff participation at the earliest stages.

b. The department will be assisted in organizing for the establishment of the program which has four objectives:
   1. Development of standards of care.
   2. Review the record keeping system for changes aimed at improving audit of records.
   3. Establish effective audit procedures.
   4. Establish feedback and modification procedures that are meaningful and effective.

c. The research staff will gather data in the following areas to describe the current operation and to follow changes that occur:
   1. Description of the patient population now flowing through the department.
   2. Description of Departmental Organization structure and process.
   3. Referral process description.
   4. Feedback process description.

d. Establish the first approximation of the quality assurance program for the first year of the project.

e. Develop measurement system for feedback process to record kind and amount of feedback.

f. Develop measurement system for quality of referrals based on criteria including appropriateness to department services, timeliness with respect to the treatment process, preparation of the patient for referral, information supplied before or with referral and others as conceived by the staff of the department.

g. Review and revise plan at end of first year in order to construct the second approximation of the program.

h. Establish the second approximation and further refine measurement and data-recording techniques.

i. Transfer entire capacity for the development of successive approximations to the operating staff.

j. Continue observation of how department staff continues process for remainder of year.

FINDINGS TO DATE: The 1976-1977 activity related to quality assurance can be divided into four general thrusts:

a. continuous review of the literature on quality assurance, together with several interviews with quality assurance experts (100+ items in current bibliography).

b. a review of charts of patients seen in the Department of Rehabilitation Medicine (150 charts reviewed to date).

c. interviews with the department chairman and between the chairman and his staff.

d. study of the methodology of organization development (180+ references in current bibliography).

APPLICABILITY: Effective demonstration of a model quality assurance program could pave the way for strengthened programs in hospital rehabilitation departments. This would have positive impact on delivery of rehabilitation services and improved patient referrals to physical restoration, vocational rehabilitation and other rehabilitation services in the community.

The program is being designed from the outset as a transferable process or methodology for developing quality assurance programs in departments of rehabilitation medicine in community hospitals.

The primary consumers will be staff personnel in departments of rehabilitation medicine. In the broad sense, this includes all staff: physicians, nurses, allied health professionals, and nonprofessionals (PT, OT, social workers, LVN's aides, orderlies, ward clerks, etc.).

If the rehabilitation medicine department in a hospital has a quality assurance program, the effective result will reach into other departments, thus disseminating the quality assurance technology throughout the hospital. Also, rehabilitation as a component of health care will gain greater positive visibility.

350 Exercise Prescription in the Hospital

Principal Investigator: **FY 1977**	**R. Cailliet, M.D.**	
Status:	**Continuing**	
Dates:	**January, 1977-May, 1978**	
Cost:	**Annual $21,162** **RT Annual $15,379**	**Projected Total $30,000** **RT % of Annual Total 73%**
Annual Report Reference:	**#10, Page 87, R-1.3**	

OBJECTIVES:

a. To identify patient data available from the hospital chart relating to rehabilitation needs, beginning with the need for exercise.

b. To assess the hospital process flow as related to the patient, and to study whether exercise is prescribed and if so, whether actual practice on hospital wards effectively carries out hospital prescriptions.

c. To develop a methodology and test an instrument for collecting data from inpatient charts.

d. To describe the patient population of the hospital through a sampling method.

e. To assess the frequency of exercise prescription as one index of practiced early rehabilitation in the hospital setting.

f. To develop data collection strategies that can be replicated in the community hospital setting.

METHODOLOGY:

a. Develop a check-list coded for electronic data processing to record data from a small sample of patient charts at LAC-USC Medical Center.

b. As a pilot study, complete check lists for a series of patients randomly selected from all services of the hospital (with certain exceptions, such as the newborn nursery).

c. Review [illegible] the pilot study; make final methodological and check list revisions indicated by this analysis.

d. Review 400 patient charts. Gather full check list data from these charts.

e. Analyze data based upon matrix chart display and other reporting methods.

f. Devise a set of concrete recommendations resulting from careful review of the conclusions drawn from the study.

g. Report exercise prescription practice in the hospital to the appropriate leaders for consideration of implications for hospital and staff education programs, as well as its relevance to total patient care.

FINDINGS TO DATE:

a. Study design has included clarification of methodology for data collection, and assessment of the data requirements of the study.

b. RT-18 devised a data collection form to facilitate chart review by the physiatrists on the staff of the Department of Rehabilitation Medicine. This form was pilot-tested with a series of patient charts randomly selected, and the data collection form modified as needed. Problems and biases encountered in this pilot examination of charts have been taken into account in the continuing planning process for this project.

c. RT-18 conducted a review of the current research and literature on various aspects of exercise and hospitalization.

APPLICABILITY: The use of exercise as a preventive measure in the community hospital could become an important practical concomitant of a well-planned overall effort to raise the level of comprehensive rehabilitation practices as a part of total hospital patient care patterns.

351 State Rehabilitation Agency as a System Serving Community Hospital Patients

Principal Investigator:	**L. Helberg, Ph.D.**	
FY 1977		
Status:	**Continuing**	
Dates:	**July, 1976-May, 1980**	
Cost:	**Annual $9,181** **RT Annual $9,181**	**Projected Total $35,000** **RT % of Annual Total 100%**
Annual Report Reference:	**#10, Page 99, R-2.0**	

OBJECTIVES:

1. To develop a description of the system of rehabilitation services with emphasis on aspects of the system relevant to providing services to community hospital patients.
2. To identify those areas in which the system could but does not link effectively with the hospital system.
3. To develop studies that can test strategies for change. This will be done after the potentials and barriers for services are identified and this aspect of the program has been related to the community hospital studies.

METHODOLOGY: The proposed study is an "umbrella" project under which the methodologies of the Survey of Subsystems of the District Office (2.1), the Medical Information System (2.2), and the Role of the State Agency Counselor in Serving Community Hospital Patients (3.3) are subsumed. This project is an integration and interpretation of the findings of these studies.

a. Literature review of the State Rehabilitation Systems, as related to the community hospital system, will be conducted with continuous updating in the subsequent grant years.

b. Interviews and observations of the State Rehabilitation Agency will be conducted in District Offices in Region IX. The focus of these interviews will be on regulations, policies and practices as related to provision of services for community hospital patients. These interviews will also provide the descriptive overview of the process flow between the State Rehabilitation Agency and the Community Hospital System.

c. Client data collected by the State, Regional and Federal rehabilitation agencies will be reviewed in order to describe the population served by vocational rehabilitation programs.

d. Client case records will be reviewed and data abstracted to describe the population referred from the community hospital to the State Agency and the process of serving the hospital referral.

These data will be compiled as a descriptive and empirical overview of the Rehabilitation System as related to the Community Hospital System. Data gathered from this project and project 1.0 (Community Hospital as a System) will be integrated with the objective of identifying or proposing a cooperative interface(s) linking the two systems.

FINDINGS TO DATE: This is the umbrella project for the following projects: Survey of Subsystems in the State Rehabilitation Agency District office (2.1), Medical Information System as a Communication Link: The State Agency Medical Record (2.2) and the Role of the State Agency Counselor in Serving Community Hospital Patients (3.3). These projects have been in operation too short a time to generate findings.

APPLICABILITY: Studies of alternative strategies which can be presented to policy makers in the rehabilitation system will provide options of strategies for change. If cost benefits, cost effectiveness and feasibility studies can be added to the description of alternative strategies these will further enhance their usefulness in the decision-making process.

Research findings will be published through monographs and journal articles and will be continuously reported to the Regional Office and State Agencies in Region IX. This will be done through person-to-person contact between Regional office, State Personnel and Center staff. Regional and State offices will be visited by Center staff in April to report on the program and to get feedback for program planning.

State Agency counselors assigned to community hospitals are participants in the Center's training program. They will test strategies for improving aspects of the State Agency system relevant to providing services.

352 Survey of the Subsystems in the State Rehabilitation Agency District Office

Principal Investigator:	**L. Helberg, Ph.D.**	
FY 1977		
Status:	**Continuing**	
Dates:	**January, 1977-May, 1978**	
Cost:	**Annual $10,317** **RT Annual $10,317**	**Projected Total $15,000** **RT % of Annual Total 100%**
Annual Report Reference:	**#10, Page 104, R-2.1**	

OBJECTIVES:

A. To describe policies, practices and staff structure in district offices that shape the linkage between the State agency and the community hospital.

B. Identify potentials for services delivery and malfunctions in the linkages.

METHODOLOGY:

A. Document review will include statutes, regulations, manuals, position papers and other descriptive materials from Federal and State agencies.

B. System description will be developed through field interviews with personnel including administrators, medical consultants, counselors, fiscal and clerical staff. Also, rehabilitation counselors serving community hospitals will be involved in a group process which will serve as a development process as well as a source of descriptive data.

C. A data inventory will be developed consisting of a variety of raw data including referral sources and referral mechanisms, hospital-rehabilitation personnel relationships, caseload characteristics, medical consultant roles, attitudes of State agency personnel toward the community hospital as a resource, budget policies and procedures, agency data collection systems, nature of services provided those ineligible for State agency services.

D. Data analysis will aim at describing barriers to service in the rehabilitation system as well as potentials for service utilization and development.

NOTE: This is a sub-project of the "State Rehabilitation Agency as a System Serving Community Hospital Patients." It is also closely related to the study of the community hospital as a system, and will provide the basis for devising strategies for change in the development of a more comprehensive rehabilitation system which includes the community hospital.

FINDINGS TO DATE: This project has had too short a time in operation to generate findings for dissemination, although the group process has been initiated and a considerable amount of descriptive data is clearly indicating a wide range of attitudes and practices within district offices of the State agencies in providing services to community hospital patients.

APPLICABILITY: Especially in efforts to serve the severely disabled the community hospital is becoming a more fruitful resource for referrals and assistance to the rehabilitation agency. With the changes that are occurring in the health care delivery system today this relationship can be fostered at the National as well as State and Local level.

353 Medical Information System as a Communication Link: The State Agency Medical Record

Principal Investigator:	**L. Helberg, Ph.D.**	
FY 1977		
Status:	**New**	
Dates:	**June, 1977-May, 1978**	
Cost:	**Annual $7,220** **RT Annual $7,220**	**Projected Total $7,220** **RT % of Annual Total 100%**
Annual Report Reference:	**#10, Page 108, R-2.2**	

OBJECTIVES:

1. To collect and describe baseline data found in client case records regarding medical diagnosis and functional limitations.
2. To study the relationship of the information gathered in objective #1 to the disposition of the case.

METHODOLOGY: A study of medical records of the California Department of Rehabilitation, Arizona Rehabilitation Services Bureau and Nevada Rehabilitation Division.

1. A sample of records of physically disabled clients referred by a health organization or a physician will be examined. If possible, all will be within three districts (one district from each state).
2. Items found in preliminary study of case records, especially in medical reports will be used to develop and test a checklist with which to evaluate all medical case records examined.

   The checklist will describe the client in terms of demographic data, rehabilitation status and information from the medical records and case notes.
3. The checklist will be used to collect data from client case records: 500 in a Southern California district, 500 in an Arizona district and 500 in a Nevada district, including 200 closed cases from fiscal year 1976 in each of the above-mentioned offices. In each state a stratified sample of closed cases will be drawn to give relative weights to closure status.
4. These data will be compared with similar data collected from caseloads of counselors currently serving community hospital patients.
5. Additional data for this study will come from: 1) medical consultant and counselor evaluations of the Center's videotape project in Medical Aspects of Disability, 2) interviews with medical consultants, counselors and personnel in the medical services unit in district offices and 3) training needs assessment and training evaluation data from the Center's counselor training programs.
6. Data from the medical reports from the sources listed above will be summarized for a description of the medical information system. Weaknesses and problems will be identified. The State agencies will be requested to review and interpret the data and make suggestions for further study by the Center.

FINDINGS TO DATE: Work on this project has been delayed pending approval of a method of access to case files for research data.

APPLICABILITY: Results from this study will be incorporated into the Center's development of alternative strategies. These strategies can be presented to policy makers in the rehabilitation system as options of strategies for change in the medical information system and in providing comprehensive rehabilitation programs. Wide variations in practices with regard to this information system could indicate a need to organize a description of the varieties of systems in use.

University of Alabama in Birmingham (RT-19)
Medical Rehabilitation Research and Training Center

CORE AREAS

Spinal Cord Injury

Projects intended to impact upon the specific course of care as well as influence eventual rehabilitation outcomes of victims of this catastrophic condition. Studies address therapeutic agents, various treatment modalities and basic research questions – each intended to fill voids in knowledge gaps so as to improve the rehabilitation outlook and potential for the spinal cord injured patient. Activities are designed to provide the professional and scientific community with data and findings applicable to medical and vocational programs.

Metabolic Effects of Severe Disability in Both Static and Dynamic Conditions

Activities addressing physical disability globally, by measuring, assessing and evaluating the disability component of a broad spectrum of conditions and/or diseases.

Assessment of Long-Term Needs of the Severely Physically Handicapped

Activities designed to lead toward the development of definitive information essential to the development of strategies to prevent the occurrence of costly interruptions to successful rehabilitation and to provide necessary services which will be readily available throughout the patient's entire lifetime.

Biocommunications

Continuing research designed to create a vast new body of knowledge relative to the process of oral communication resulting in a continual increase in the understanding of the physiologic and anatomic basis of problems – leading to the development of corrective therapeutic modalities. Knowledge and skills growing out of this work will markedly improve the patient/client's ability to participate successfully in a vocational rehabilitation program.

UNIVERSITY OF ALABAMA

Samuel Stover, M.D., Director
University of Alabama Medical
Rehabilitation Research and Training Center
1717 Sixth Avenue, South
Birmingham, Alabama 35233

PROJECT TITLES BY FY 1977 STATUS

COMPLETED

ABSTRACT NO.

The Effect of Disodium Etidronate (Disphosphonate) on Acute Osteoporosis (Samuel L. Stover, M.D.) 354

Electromyographic Findings in the Upper and in the Lower Motor Neuron Diseases: A Differential Analysis (John M. Miller, III, M.D.) 355

Development of a System for Determination of Frequency and Volume of Urination in Patients with Spinal Cord Injuries (Samuel L. Stover, M.D.) 356

The H-Reflex as an Indicator of Spinal Center Integrity (Samuel L. Stover, M.D.) 357

Effective Training in Rehabilitation Medicine in New Medical School Curricula (Evaluation Systems Inc.) 358

Development and Evaluation of Automatic Warning Device to Help Prevent Pressure Ulcers in Wheelchair Patients (Keith V. Kuhlemeier, Ph.D.) 359

Modification of Nasality in Utterances of Deaf Speakers (Jerry Higgins, Ph.D.) 360

CONTINUING

The Effect of Disodium Etidronate on the Recurrence of Ectopic Calcification Following Surgical Removal (Samuel L. Stover, M.D.) 361

Evaluation of Long-Term Urinary Sterilization in Catheter-Free Paraplegics (Samuel L. Stover, M.D.) 362

Localization of Urinary Tract Infection by Identifying Bacterial Antibody-Coating with Immunofluorescence (Samuel L. Stover, M.D.) 363

The Importance of Central and Peripheral Temperatures in Maintaining Euthermia in Patients with Spinal Cord Injuries (Keith V. Kuhlemeier, Ph.D.) 364

Clinical Assessment of Psychological Adjustment to Spinal Cord Injury (Margaret S. Marcus) 365

Energy Expenditures While Performing Normal Street Walking — A Comprehensive Study Using MAMA and Involving Paraplegics, Stroke Patients and Amputees, as Well as Normal Subjects, and a Variety of Assistive Devices (Chi-Tsou Huang, M.D.) 366

Overcoming Disincentives to the Rehabilitation of SSI and SSDI Beneficiaries (Samuel L. Stover, M.D.) 367

Renal Scintillation Camera Studies as a Method of Following Renal Function and Urological Management in Spinal Cord Injury Patients with Neurogenic Bladder (Samuel L. Stover, M.D.) 368

Long-Term Follow-up Studies of Patients with Spinal Cord Injury Who Became Catheter Free Following an Intermittent Catherization Program (Samuel L. Stover, M.D.) 369

Pain in Spinal Cord Injury (C. S. Nepomuceno, M.D.) 370

Preliminary Investigation of Micrographic Viewer for Use by Disabled Persons (James R. Jackson) 371

Assessment and Evaluation of Home Health Team Activities (Samuel L. Stover, M.D.) 372

Linguaplatal Cues as an Aid to Consonant Articulation in Deaf Adults (Samuel G. Fletcher, Ph.D.) 373

DISCONTINUED 1976

An Hydraulic Driven Stand-up Brace for Paraplegics (John M. Miller, III, M.D.)

DISCONTINUED 1977

The Significance of the H-Reflex as a Prognostic Indicator in Spinal Shock (Chi-Tsou Huang, M.D.)

PROPOSED

Bowel Regulation in Spinal Cord Injury (Cecilio S. Nepomuceno, M.D.)

Effect of Dantrolene Sodium on the Efflux of Calcium From Isolated Sarcoplasmic Reticulum Visicles (Kennon Frances, Ph.D.)

Electromyographic Findings in Spastic and in Flaccid Spinal Cord Injury (Cecilio S. Nepomuceno, M.D.)

Frequency and Volume of Urination in Patients with Spinal Cord Injuries (L. Keith Lloyd, M.D.)

Mechanisms of Pyelonephritis in Spinal Cord Injured Patients (George Hemstreet, M.D., Ph.D.)

354 The Effect of Disodium Etidronate (Diphosphonate) on Acute Osteoporosis

Principal Investigator:	Samuel L. Stover, M.D.	
FY 1976		
Status:	Continuing	
Dates:	October, 1970-June, 1977	
Cost:	Annual $19,397 RT Annual $3,918	Projected Total (not available) RT % of Annual Total 20%
Annual Report Reference:	#10, Page A-39, R-14	
FY 1977		
Status:	**Completed**	
Dates:	**October, 1970-December, 1976**	
Cost:	**Annual $20,746** **RT Annual $3,382**	**Projected Total –** **RT % of Annual Total 16%**
Annual Report Reference:	**#11, Page A-77, R-14**	

OBJECTIVES:

1. To assess the effectiveness of disodium etidronate (EHDP) as a therapeutic agent in preventing the formation of heterotopic ossification (HO) following spinal cord injury;
2. To study the effect of EHDP in the prevention of HO between 22 and 112 days post-spinal cord injury, the period of time during which HO development is most frequent;
3. To determine whether EHDP simply delays or actually prevents the formation of ectopic bone.

METHODOLOGY: 157 spinal cord injury patients participated in a multi-clinic double-blind study between 1972 and 1975. All patients were male, 16 years of age or older. L-2 was the lowest neurological level accepted into the study and all patients must have had complete motor-paralysis. Clinical study was initiated 22 to 121 days after injury with a treatment period limited to 12 weeks. Patients with severe acute or chronic disease which might interfere with interpretation of results were excluded. Patients receiving hormone therapy or who had received steroids for longer than 2 weeks just after injury were excluded. A battery of prestudy laboratory examinations was performed to establish base-line data. EHDP was given in a dosage of approximately 20 mg/kg/day for the first 2 weeks followed by 10 mg/kg/day for the remainder of the study. Both drug and placebo were supplied as 200 mg tablets and administered once daily. All patients were maintained on a routine diet and continued participation in a regular rehabilitation program. Bi-weekly serum alkaline phosphatase determinations were made in addition to repeating SMA-18 studies during the 8th and 12th weeks of the investigation. AP and lateral x-rays of the hips and knees were obtained every 4 weeks throughout the study.

Radiologic evidence of HO was graded by investigators on a blind-basis with the grader being unaware of which treatment regime the patient was on. HO was graded on a scale of 0 to 4 with the former corresponding to the absence of HO and the latter score corresponding to the maximum amount of HO expected to develop. Grading methods consider the size, maturity, location and clinical significance of the heterotopic mass(es).

FINDINGS TO DATE: 157 (76 placebo/81 EHDP) completed 12 weeks of placebo or drug therapy. At prestudy time ($\bar{x}$ 56 days placebo/$\bar{x}$ 58 days EHDP) 17% of the placebo patients and 15% of the EHDP patients demonstrated x-ray evidence of HO about the hips and/or knees. After the 12th week of the study there was a 20% increase in the prevalence of HO in the placebo group and a 4% increase in the EHDP group; that is, poststudy prevalence was 37% and 19% respectfully. Analysis revealed a statistically significant advantage ($P < .05$) for patients receiving EHDP, in reduced post-treatment prevalence. Of 76 placebo patients, 48 were negative for HO, prestudy and post-study, 13 were positive prestudy and 15 became positive for HO during the 12 week study. Of 81 patients in the EHDP group, 66 remained negative, both prestudy and post-study, 12 were positive prestudy and 3 became positive for HO during the study. There was significantly less HO development in the EHDP group compared to the placebo group among patients who develop any degree of HO during the study or who already had evidence of HO before EHDP therapy was initiated.

Analysis of data indicates treatment with 20 mg/EHDP/kg/day prevents clinically significant (ankylosing) lesions of HO from forming about the hips. The mean total grade of HO in EHDP patients was significantly less ($P < .05$) compared to placebo treated patients. There is also evidence EHDP treatment started less than 60 days after injury is more effective than when started more than 60 days after time of injury. Delayed fractural healing and other long bone healing did not appear. EHDP may have an abortive effect on the pathogenesis of HO by inhibiting mineralization. There was no x-ray evidence of recurrent ossification while EHDP treatment continued for as long as 9 months. Termination of drug treatment allowed variable recurrence with evidence that extent of recurrence was inversely proportional to length of EHDP therapy and size of initial bone mass.

APPLICABILITY: These findings suggest EHDP can be effective in the prevention of HO if given before pathogenesis is initiated. EHDP has little known affect on preexisting HO, but may reduce the extensiveness of HO which is in the early process of formation. Further studies are necessary to determine the optimal time to institute EHDP treatment, length of treatment and minimal effective dosage. Since EHDP is the first known therapeutic agent found effective in prevention of HO, it may also prove useful in further studies to elucidate the etiology and pathogenesis of pathologic ossification.

355 Electromyographic Findings in the Upper and in the Lower Motor Neuron Diseases: A Differential Analysis

Principal Investigator	John M. Miller, III, M.D.	
FY 1976		
Status	Completed	
Dates	March 1975	
Cost	Annual $18,228	Projected Total $19,435
	RT Annual $10,267	RT % of Annual Total 56%
Annual Report Reference	#10, Page A-51, R-31	

OBJECTIVES: To challenge the indistinguishability of the denervation potentials found in upper motor neuron and lower motor neuron disorders.

METHODOLOGY: 25 patients with upper motor neuron disorders (hemispheric brain damage) and 25 with lower motor neuron lesions constituted the study population. No subjects had history of trauma, diabetes mellitus, uremia, alcoholism or any other condition thought to involve the lower motor neuron or the motor unit.

Utilizing TECA Model 3 or 4 electromyographs, EMG recordings were obtained and analyzed. Sensitivity was adjusted to 200 micro-volt/cm, 10 msec/sweep duration, low frequency response (−3 bd) of 10 kiloHertz. Positive sharp waves were graded as occasional, few and many and the fibrillation potentials were graded conventionally from (−) to (+ + + +). Percutaneous needle muscle biopsy was accomplished when many positive sharp waves or grade + + + to + + + + fibrillation potentials were observed.

Motor nerve conduction velocity was determined in the conventional manner using the ulnar nerve in the upper and deep peroneal nerve in the lower limbs. Sensory nerve conduction was done in the median nerve in the upper and in the sural nerve in the lower limbs. All positive EMG examinations were recorded using a standard ¼" magnetic tape recorder having a −3 db frequency response of 18 Hertz to 8 kiloHertz. A 200 micro-volt root mean square (RMS) sine wave having a frequency of 250 Hertz was applied to the EMG amplifier input and recorded as a calibration signal. Computations were accomplished upon an XDS Sigma 7 computer. Calibration of the digital data was accomplished by calculating a gain and DC level from the digitized calibration sinusoid knowing the RMS amplitude (200 micro-volts) and DC value (0) of the recorded analog signal. Values of gain and DC level were then used to scale the digital EMG data before analysis.

FINDINGS TO DATE: Positive sharp waves and fibrillation potentials appear in both the upper motor neuron and lower motor neuron lesions but there are differences in the mean frequency of occurrence ratios and durational wave parameters between the two groups. The most significant difference is that the lower motor neuron positive sharp wave has a longer duration than the upper motor neuron positive sharp wave ($P < 0.015$).

APPLICABILITY: The findings of this study suggest needed change in the basic teaching of electromyography. The fibrillation and positive sharp wave potentials can no longer be considered pathognomonic of lower motor neuron pathology. The fibrillation potentials appear identical in lower and upper motor neuron conditions. However, the positive sharp waves are different and can be the best clue in the diagnosis of the patient's condition. Since the treatment of upper and lower motor neuron conditions may vary, the procedure described can be performed in the findings utilized as a clinical guide in patient management.

356 Development of a System for Determination of Frequency and Volume of Urination in Patients with Spinal Cord Injuries

Principal Investigator	Samuel L. Stover, M.D.	
FY 1976		
Status	Continuing	
Dates	June, 1975-June, 1976	
Cost	Annual $12,536 RT Annual $9,803	Projected Total $12,536 RT % of Annual Total 78%
Annual Report Reference	#10, Page A-83, R-42	
FY 1977		
Status:	**Completed**	
Dates:	**June, 1975-December, 1976**	
Cost:	**Annual $7,932** **RT Annual $4,855**	**Projected Total $20,468** **RT % of Annual Total 61%**
Annual Report Reference:	**#11, Page A-121, R-42**	

OBJECTIVES: To develop an automatic urine collection system allowing voiding patterns of spinal cord injury patients to be determined and studied in conjunction with cystometric examinations and an intermittent catherization program.

METHODOLOGY: The uroflowmeter was developed in 3 separate stages. First, a signal acquisition and control subsystem was developed. This subsystem allowed a known volume of urine to enter a vessel, generate a signal pulse and then empty the vessel. Control of fluid flow into and out of the vessel is accomplished by electronically activated valves and associated circuitry.

Second, a processing subsystem was devised which counted signals from the signal acquisition and control subsystem and converted them into suitable input for the display subsystem.

Finally, a display subsystem which provided a written record of voiding patterns was developed. A prototype which satisfied all methodologic criteria has been created. Sensitivity of the instrument and verification of its incremental volume measurement capacity has been completed.

FINDINGS TO DATE: Statistical analyses of the mean flow volume at various flow rates indicates that the uroflowmeter produces meaningful clinical data. In addition to laboratory evaluations several patient trials have been conducted. Minor modifications are planned for future clinical versions and will provide cumulative representations of urine output, as well as additional electronics to prevent eruption of data display by AC power failures and smaller packaging of the unit.

APPLICABILITY: Many techniques have been recommended for clinical management of patients with neurogenic bladder, especially those with spinal cord injury. It is important to determine what the usual (normal) voiding pattern is for patients with such a disability. This project is an attempt to devise a method to accurately determine frequency and volume of voiding so that treatment methods such as intermittent catherization and urinary diversion procedures can be better evaluated. Determination of voiding patterns in patients who are participating in an intermittent catherization program will allow better bladder management so that associated problems can be minimized. Modification of voiding patterns to conform to needs of patients will be much easier if patterns can be characterized with precision and accuracy. This is especially important in designing a treatment program for females who have sustained spinal cord injury and for whom there is no effective urinary collection device. A by-product of the clinical application is in the ability of the device to be used in the study of various effects of drugs in the neurogenic bladder.

357 The H-Reflex as an Indicator of Spinal Center Integrity

Principal Investigator	Samuel L. Stover, M.D.	
FY 1976		
Status	Completed	
Dates	December, 1973-December, 1975	
Cost	Annual $16,488 RT Annual $11,664	Projected Total $34,624 RT % of Annual Total 71%
Annual Report Reference	#10, Page A-91, R-43	

OBJECTIVES:

1. To determine whether any strong correlation exists between the presence or absence of the H-Reflex in spinal cord injury patients with upper motor neuron lesions who were either successful or unsuccessful participants in an intermittent catheterization program.
2. To determine whether the H-Reflex can be used as a prognostic indicator for eventual success or failure in an intermittent catheterization program.

METHODOLOGY: A TECA-3 model electromyograph equipped with on-board photographic equipment and paper tape recording capability was used in this study. An experimental and a control group were established with testing being accomplished among all subjects for the presence or absence of the H-Reflex. 25 control subjects in addition to 48 spinal cord injury patients with upper motor neuron lesions who were participating in an intermittent catheterization program were tested. All subjects were placed in a prone position with the lower portions of the legs exposed. An attempt to elicit the H-Reflex was made by stimulation of the tibial nerve in the popliteal fossa through the use of stimulating electrodes. The duration of stimulation ranged from 0.1 milliseconds to 1.0 milliseconds. Stimuli were applied at the rate of 1 per second. Surface pickups, reference and ground electrodes were applied to the patient's belly. The gastrocnemius muscle mass ground electrode was located between the stimulating and the pickup electrode. Elicitation of the H-wave was recorded with a stroke time indicator and photographically with a Polaroid camera. Comparison in incidence and time was made between 3 groups (successful, unsuccessful and current) of patients participating in the intermittent catheterization program, in addition to comparisons between those electromyographic responses elicited from control subjects.

FINDINGS TO DATE: The H-Reflex was demonstrated in 23 of 25 control subjects. This extraordinarily high percentage of positive findings differs markedly from previous studies which report a far lower incidence of the H-Reflex in normal populations. It could not be determined whether the incidence the H-Reflex reflected peculiarity of the control population or whether in fact the abnormally high incidence was reflection of the degree of accuracy of EMG interpretation. It is possible some bias may have existed because multiple readers were not involved. 36 of 48 spinal cord injury victims with upper motor neuron lesions who were less than 50 years of age and who were participating in an intermittent catheterization program were tested for the presence of the H-Reflex. Review of the data suggests a difference between those 2 groups who were successful or unsuccessful in an intermittent catheterization program as well as a difference between those groups in whom the H-Reflex was either present or absent. It could not be determined whether this reflected a cause effect relationship between those in whom the H-Reflex was present and who were successful on an intermittent catheterization program and the group which was not successful and in whom the H-Reflex was absent. Using Fisher's exact test, a probability score of 0.023 was calculated. We cannot concur from the findings that there is 1 to 1 dependency (H-Reflex presence: successful intermittent catheterization program), we can conclude however that the entities are not entirely independent. The most meaningful interpretation appears to be consideration of the presence or absence of the H-Reflex as simply additional laboratory data to be considered as contributory information amongst the vast array of findings. It seems that in the presence of the H-Reflex, the patient may not be a successful intermittent catheterization program participant; but if the H-Reflex is absent, the likelihood of successful participation in an intermittent catheterization program is markedly reduced.

APPLICABILITY: Intermittent catheterization is an expensive, time consuming procedure, frequently requiring extensive equipment and protracted hospitalization. Although many patients respond well to this program and develop a reflex-emptying bladder, some patients do not. Any additional tool or technique which would have prognostic significance for those patients who would be good candidates for intermittent catheterization or early surgical procedures to enhance the potential of this program could save the State VR Agency and other third party carriers considerable money. The current practice of attempting intermittent catheterization for 6 weeks or more before looking for other means of bladder drainage could be considerably shortened with such prognostic tools.

358 Effective Training in Rehabilitation Medicine in New Medical School Curricula

Principal Investigator:	Evaluation Systems, Inc.[*]	
FY 1976		
Status:	Continuing	
Dates:	October, 1974-October, 1976	
Cost:[*]	Annual –	Projected Total $37,000
	RT Annual –	RT % of Annual Total 18.5%
Annual Report Reference:	#10, Page A-103, R-46	
FY 1977		
Status:	**Completed**	
Dates:		
Cost:	**Annual No Funds**	**Projected Total $5,000**
	RT Annual –	**RT % of Annual Total –**
Annual Report Reference:	**#11, Page A-133, R-46**	

[*] Project funded by a consortium of R&T Centers, with work conducted by social scientists in Health Manpower Division of Evaluation Systems, Inc.

OBJECTIVES:

1. To determine the extent to which exposure to rehabilitation medicine (RM) experiences during medical school helps develop, in future practitioners, an understanding of the nature of chronic illness, physical disability, complications and the working knowledge of the contribution which RM offers to meet the needs of the chronically ill and physically disabled.
2. To determine whether exposure stimulates positive attitudes towards RM and effective practice behavior in providing care for the chronically and severely physically disabled.

METHODOLOGY: This study utilized a retrospective research design (questionnaire) intended to examine situations and events which have occurred in 4 medical schools. The questionnaire assessed approaches of acquainting students with RM in 3 select schools. Outcomes of these training experiences are contrasted with outcomes achieved by students in 1 comparison school which, until recently, had a very limited school RM curriculum.

FINDINGS TO DATE: A total of 1,497 complete and usable responses were received from a questionnaire mailing to 3,211 graduates. Response to this survey was calculated to be 49%.

The study was completed during December, 1976, and the monograph detailing its findings and general conclusions will be available in the near future.

Generally, it appears the degree of exposure to RM during medical school is positively associated with later effective practice behavior in dealing with chronically ill and severely disabled individuals. Further, attitudes toward RM appear to be associated with identifiable medical school experiences. The installation of more effective RM educational experiences could eventually lead to a greater proportion of the nation's severely disabled and chronically ill receiving more effective rehabilitation services.

APPLICABILITY: RM must compete with other more colorful and remunerative careers to entice well qualified medical students to enter the field. The findings may help to implement RSA priorities and health manpower development. The shortage of specialists in RM has been repeatedly documented and the number of new physicians entering this field is far short of the demand being created for medical rehabilitation services.

359 Development and Evaluation of Automatic Warning Device to Help Prevent Pressure Ulcers in Wheelchair Patients

Principal Investigator	James R. Jackson	
FY 1976		
Status	Continuing	
Dates	January, 1975-January, 1977	
Cost	Annual $5,927 RT Annual $4,116	Projected Total $14,716 RT % of Annual Total 70%
Annual Report Reference	#10, Page A-139, R-49	

Principal Investigator:	**Keith V. Kuhlemeier, Ph.D.**	
FY 1977		
Status:	**Completed**	
Dates:	**January, 1975-January, 1977**	
Cost:	**Annual $6,526** **RT Annual $4,177**	**Projected Total $12,453** **RT % of Annual Total 64%**
Annual Report Reference:	**#11, Page A-159, R-49**	

OBJECTIVES: To develop, modify and evaluate devices that remind the patient to initiate a pressure-relieving push-up to aid in the prevention of development of decubitus ulcers.

METHODOLOGY: A device consisting of a time-interval programmer, audio and visual alarm, rechargeable batteries and a mode selector has been designed, developed and is being evaluated by patient users. The push-up timer device has a pressure sensitive pad which is placed between the patient and the seat cushion of the wheelchair. The timed delay circuitry reminds the patient, by audio or visual alarm, to initiate and complete a push-up at a given time interval from the last satisfactory push-up. The length (time) of the push-up is measured and if sufficiently long, the device automatically resets and begins a new cycle. The electronic circuitry also enables the patient to "beat the alarm" by resetting itself before the time interval elapses if a satisfactory push-up is accomplished.

FINDINGS TO DATE: A commercially available wheelchair push-up reminder was identified and evaluated. This device was projected to have a retail cost lower than the projected cost of commercially manufacturing our current design. We have evaluated the preproduction prototype and are generally pleased with its performance. Several minor engineering problems were identified and this information was passed on to the manufacturer. At present both the RT-19 design and the commercially available push-up reminder are being evaluated in the field by patient users.

APPLICABILITY: Pressure sources, a common source of morbidity among spinal cord injury patients, often cause absenteeism from vocational placement. In addition, decubitus ulcers can require protracted periods of hospitalization for treatment. Conditioning of the patient to perform wheelchair push-ups at regular intervals is an essential part of the patient's rehabilitation experience. The availability of an inexpensive device of this nature and design will help prevent additional physical complications to the patient's rehabilitation while in the hospital and at the same time make him more independent of staff. A modified version of the device could be attached to a patient's bed and used to assist staff members in remembering to reposition the patient at regular intervals. Such a device will provide the patient with independent reminders away from the hospital, prevent his return for treatment of pressure ulcers and decrease the overall cost of care.

360 Modification of Nasality in Utterances of Deaf Speakers

Principal Investigator	Jerry Higgins, Ph.D.	
FY 1976		
Status	Continuing	
Dates	March, 1975-July, 1976	
Cost	Annual $14,417 RT Annual $10,917	Projected Total $14,417 RT % of Annual Total 76%
Annual Report Reference	#10, Page A-195, R-54	
FY 1977		
Status:	**Completed**	
Dates:	**March, 1975-December, 1976**	
Cost:	**Annual $14,417** **RT Annual $10,917**	**Projected Total $14,417** **RT % of Annual Total 76%**
Annual Report Reference:	**#11, Page A-243, R-54**	

OBJECTIVES: To investigate the ability of hearing impaired subjects to reduce nasalance in their speech in response to visual feedback.

METHODOLOGY: An instrument known as TONAR 2, designed to detect reductions in nasalance and provide rapid visual feedback as a mechanism to improve nasalance control, is utilized. The speaker reads and/or repeats sentences into a sound separator and the separate nasal components of utterances are converted into electrical impulses and relayed to a control console. Nasalance ratios are instrumentally calculated according to the formula: $\bar{N}/(\bar{N} + \bar{O})$ with results being multipled by 100 to convert to percentage. Scores derived are displayed in meter analog and digital form. A goal ratio is provided for scoring reductions in nasalance. Nasalance levels calculated from the speaker's response are automatically compared with that specified on the goal ratio dial. If the nasalance equals or is lower than the specified goal ratio level, the response is scored as a success and the speaker is notified by activation of lights on a reinforcement panel and registered on a separate panel counter. Unsuccessful vocalization is simply counted as a trial and registered. Lights and counters may be reset at any time at the discretion of the examiner. A record of the trials and successes is continually available and information is updated with each response. All data are recorded on a two-channel audio tape recorder coupled to the output of the TONAR 2 instrument.

FINDINGS TO DATE: Results of data analysis on 13 subjects support the hypothesis that use of visual feedback enables the hearing impaired to recognize and modify their nasalance.

Although resultant increased intelligibility of speech was not studied in this project, it is reasonable to assume a reduction in significant nasalance would contribute to increased intelligibility of verbal communication.

APPLICABILITY: A significantly high proportion of the hearing impaired population has been shown to have hypernasal speech. This is of more than academic interest since the overlaid presence of general nasal resonance can be highly disturbing to a listener and may also cause a marked reduction in the intelligibility of speech. Since results of this study demonstrate that TONAR 2 provides a means of enabling hearing impaired individuals to recognize and modify nasalance, the portents for increasing the intelligibility of their speech should be of significance to rehabilitation workers.

361 The Effect of Disodium Etidronate on the Recurrence of Ectopic Calcification Following Surgical Removal

Principal Investigator	Samuel L. Stover, M.D.	
FY 1976		
Status	Continuing	
Dates	October, 1977-June, 1977	
Cost	Annual $21,297 RT Annual $6,218	Projected Total (not available) RT % of Annual Total 29%
Annual Report Reference	#10, Page A-25, R-13	

FY 1977

Status:	**Continuing**	
Dates:	**October, 1970-June, 1980**	
Cost:	**Annual $18,668**	**Projected Total (N.A.)**
	RT Annual $6,708	**RT % of Annual Total 36%**
Annual Report Reference:	**#11, Page A-43, R-13**	

OBJECTIVES:

1. To demonstrate effectiveness of disodium etidronate (EHDP) in preventing postoperative recurrence of heterotopic ossification (HO) in patients with spinal cord injury, ankylosing spondylosis and other severe neurological conditions in which surgical excision of the heterotopic bone is indicated;
2. To demonstrate that prevention of postoperative occurrence allows greater joint range of motion and improved function.

METHODOLOGY: This long-term study has utilized three protocols. The patient population was restricted to persons 16 years of age or older who suffered spinal cord injuries or who, because of other severe neurological injuries or illnesses, developed HO requiring surgical intervention. The experimental drug, EHDP, is administered both pre- and postoperatively for varying periods of time. In the first protocol completed in 1974 the patient served as his/her own control. Subsequent protocols were double-blind studies distinguishable by the length of postoperative administration of drug and dosage following surgery. Patients are followed closely correlating laboratory studies, clinical course, joint range of motion and x-ray findings to evaluate the efficacy of the drug.

FINDINGS TO DATE: Examination of current data acquired on patients who received placebo in the double-blind study, as well as the data acquired from those who received the drug in the double-blind study and drug in the controlled study reveals rather definitive information.

Four spinal cord injury patients had a total of 7 wedge-resections for HO in 5 hips. 2 patients served as their own control. 2 patients were on the double-blind study; 1 receiving EHDP and one placebo. A comparison of postoperative results following 3 wedge resections among untreated or placebo patients to results from patients treated with EHDP demonstrated the efficacy of the drug in prevention of postoperative recurrence. This is evidenced by the fact that HO was demonstrated on x-ray less than 3 weeks postoperatively in all 3 non-treated and placebo patients, progressing to recurrent ankylosis despite efforts to maintain range of motion.

During the past year 7 additional patients entered the series. A total of 8 operative procedures for the removal of HO have been performed. The study population now consists of 14 patients who have undergone a total of 22 procedures. Further breakdown of procedures reveals removal of heterotopic bone occurring about the hip in 13 patients (21 procedures) and removal of heterotopic bone occurring about the elbow in 1 patient (1 procedure). Among those patients receiving placebo, 7 patients underwent a total of 8 procedures. Of these, 5 experienced postoperative recurrence within 3 weeks of surgery. 4 of 5 patients receiving drugs who had undergone a total of 5 surgical procedures experienced no recurrence.

EHDP is the first therapeutic agent with definitive effectiveness in delaying and partially preventing recurrent postoperative HO. In the 3 protocols utilized in this study, the length of time of EHDP treatment is variable. After drug withdrawal the extent of HO recurrence appears to be inversely proportional to the size of the initial bone mass and the length of treatment. Maturity of HO does not seem to influence the effect of EHDP but may influence the recurrence after drug withdrawal. Longer treatment periods may further decrease the extent of recurrence allowing patients to achieve and maintain improved joint mobility and function.

APPLICABILITY: HO is a common complication of spinal cord injury necessitating absenteeism and surgical removal when sufficiently severe to inhibit range of motion of the joints, particularly the hips, to make the patient functionally as independent as possible and prevent the usual recurrence of ectopic bone.

This drug shows considerable promise in preventing recurrence of ectopic bone (HO) formation after surgical excision.

362 Evaluation of Long-Term Urinary Sterilization in Catheter-Free Paraplegics

Principal Investigator:	Samuel L. Stover, M.D.	
FY 1976		
Status:	Continuing	
Dates:	June, 1973-December, 1976	
Cost:	Annual $6,593 RT Annual $4,487	Projected Total $34,058 RT % of Annual Total 68%
Annual Report Reference:	#10, Page A-73, R-37	
FY 1977		
Status:	**Continuing**	
Dates:	**June, 1973-December, 1977**	
Cost:	**Annual $11,840** **RT Annual $5,181**	**Projected Total $52,114** **RT % of Annual Total 44%**
Annual Report Reference:	**#11, Page A-109, R-37**	

OBJECTIVES:

1. To determine the length of time patients with complete spinal cord injury (SCI) continue to have sterile urine after appropriate antibiotic therapy and during prophalactic trials with both methenamine hippurate (hiprex) and ascorbic acid;
2. To compare the effectiveness of methenamine hippurate to ascorbic acid in 100 patients with complete SCI in a random study.

METHODOLOGY: Spinal cord injury patients with complete neurological loss below the level of injury and no signs of chronic renal insufficiency constitute the study population. Subsequent to initiation of an intermittent catheterization program (ICP), 2 urine cultures will be obtained. Antibiotic treatment is given for 7 to 10 days to acquire a sterile urine. During the same time patients are randomly placed on either methenamine hippurate or ascorbic acid. Urine specimens are considered sterile if the colony count is < 1000 colonies/ml. If sterile urine is not obtained, the patient is dropped from the study. Urine ph is checked daily and both groups are evaluated for urine ph of 6.0 or less. Follow-up urine cultures, colony counts and sensitivities are performed weekly and at approximately 1, 2 and 6 month intervals following discharge. Recurrence of bacteriuria results in discontinuation of the patient from the study. Patients receiving methenamine hippurate who have maintained sterile urine for 6 months then have the drug discontinued. The patient is followed for recurrence. Patients experiencing recurrent bacteriuria on 2 consecutive cultures receive appropriate antibiotic therapy by standard sensitivity techniques and may again be randomized into a treatment or control group. Data is analyzed to determine whether a statistically significant difference in the incidence of bacteriuria exists between those treated with methenamine hippurate or ascorbic acid.

FINDINGS TO DATE: 84 patients have participated in the study. 41 patients received ascorbic acid; 43 patients received methenamine hippurate. Of 43 receiving methenamine hippurate, 19 continued with a sterile urine for more than 4 weeks. 6 continued to have sterile urine for 6 months or more. Of 41 patients receiving ascorbic acid, only 2 maintained sterile urine for more than 4 weeks. These data suggest methenamine hippurate is more effective than ascorbic acid in preventing relapse and reinfection of the urinary tract in patients who have sustained complete neurological lesions. It is recognized that patients receiving methenamine hippurate treatment in this study cannot be compared to patients who would not receive any drug therapy at all; however, there is increasing evidence ascorbic acid has very little affect in preventing relapse or reinfection and its action seems comparable to the absence of drug therapy.

APPLICABILITY: The ultimate goals of an ICP include removal of the indwelling catheter and maintenance of a sterile urine. If methenamine hippurate is effective in the maintenance of a sterile urine and the prevention of recurrent urinary tract infections, its cost would obviously be justified. In addition, the dosage regime seems far more acceptable to the patient than the regime required of ascorbic acid. Recurrent urinary tract infections are one of the most frequent reasons for repeated hospitalization and also lead to recurrent urinary tract calculi which often require hospitalization and surgery. Any method of therapy which assists in maintenance of a sterile urine will be invaluable in the prevention of renal deterioration, will decrease the cost of repeated hospitalization and will permit the patient to continue pursuing vocational objectives.

363 Localization of Urinary Tract Infection by Identifying Bacterial Antibody-Coating with Immunofluorescence

Principal Investigator: Samuel L. Stover, M.D.
FY 1976
Status: Continuing
Dates: January, 1975-December, 1977
Cost: Annual $11,533 Projected Total $24,219
RT Annual $5,545 RT % of Annual Total 48%
Annual Report Reference: #10, Page A-115, R-47
FY 1977
Status: Continuing
Dates: January, 1975-December, 1977
Cost: Annual $12,863 Projected Total $36,545
RT Annual $6,077 RT % of Annual Total 47%
Annual Report Reference: #11, Page A-149, R-47

OBJECTIVES:

1. To evaluate the immunofluorescence test as a simple clinical method to differentiate localization of upper urinary tract infection from lower urinary tract infection in spinal cord injury patients with neurogenic bladders who have initial or recurrent bacteriuria;
2. To correlate immunofluorescence findings with clinical signs, symptoms, urine cultures, cystograms, intravenous urograms and follow-up renal studies;
3. To determine, when bacteria are positive for immunofluorescence, whether the antibody coating is secondary to renal origin or prostatic origin.

METHODOLOGY: 100 patients with bacteriuria of known origin will have urinary sediment examined by the immunofluorescence technique of Thomas, et al., for the detection of antibody coating. The study population will include spinal cord injury victims who are catheter-free but continue to have persistent bacteriuria. Results of the immunofluorescence test will be correlated with clinical findings and impressions, urinary cultures, radiologic evidence of urinary tract calculi and the presence of any upper urinary tract involvement as revealed via intravenous pyelogram.

FINDINGS TO DATE: 34 patients have been tested. Of these, 14 demonstrated upper tract changes on IVP. Of the 14 patients demonstrating upper tract changes, 11 exhibited fluorescent bacteria on at least 1 occasion. The remaining 20 patients demonstrated normal IVP's. Of these, 14 had bacteria exhibiting fluorescence while 6 did not. Urine has also been collected by ureteral catheterization in 6 patients found to have infected ureteral urine. Of these, 5 were found to exhibit antibody coated bacteria. In addition, a method has been devised for obtaining samples of prostatic fluid which will be examined for the presence of fluorescent bacteria.

APPLICABILITY: Urinary tract infection and calculi, which are often interdependent, are among the most frequent complications observed in patients who have sustained spinal cord injury. Although the neurogenic bladder has been studied extensively in the past, renal failure secondary to chronic pyelonephritis is still a major cause of death among these patients. Urinary tract complications account for many of the initial prolonged hospitalizations and frequent readmissions experienced by spinal cord injury victims. Despite progress made through use of intermittent catheterization, chronic bacteriuria and urinary tract complications remain a major health problem. If the source of urinary tract infection could be isolated to the bladder (without evidence of upper tract involvement), the protracted and costly treatment program might be markedly reduced and efforts could then be directed toward treating patients in whom bacteriuria is being produced in the upper urinary tract and among whom gradual renal deterioration can be expected. This procedure could represent a relatively inexpensive clinical laboratory technique that might eventually replace other expensive and time consuming tasks currently being used to localize the source of bacteriuria. If proven to be of value, the immunofluorescence test might also be helpful to many other rehabilitation patients who suffer neurogenic bladder problems.

364 The Importance of Central and Peripheral Temperatures in Maintaining Euthermia in Patients with Spinal Cord Injuries

Principal Investigator:	Keith V. Kuhlemeier, Ph.D.	
FY 1976		
Status:	Continuing	
Dates:	June, 1975-December, 1977	
Cost:	Annual $10,677 RT Annual $9,086	Projected Total $37,604 RT % of Annual Total 85%
Annual Report Reference:	#10, Page A-149, R-50	
FY 1977		
Status:	**Continuing**	
Dates:	**June, 1975-December, 1977**	
Cost:	**Annual $26,759** **RT Annual $14,546**	**Projected Total $48,903** **RT % of Annual Total 54%**
Annual Report Reference:	**#11, Page A-171, R-50**	

OBJECTIVES:

1. To determine "set points" of skin and core temperature, for temperature effector systems at several levels of skin temperatures when the body is not in oxygen debt;
2. To determine the most effective way to cool hyperthermic patients;
3. To determine whether skin receptors are part of a "feed forward" signal by measuring sweat rates at a given location and oxygen consumption.

METHODOLOGY: Subjects are adult spinal cord injury patients with neurologically complete lesions at the thoracic level. Core temperatures are manipulated by heating or cooling insentient parts of the body with warm (42°C) or cold (5°C) water. Sentient skin temperatures are measured at the chest, sternum, hand, forearm, upper arm and forehead and averaged to obtain mean skin temperature. Core temperatures are measured sublingually. Sweat rates are measured 3.5 cm above the left nipple. Oxygen consumptions are measured with a mobile automatic metabolic analyzer. Temperatures are measured with a Honeywell multipoint temperature recorder utilizing copper constantan thermocouple. A temperature controlled water bath is used to maintain the temperature of water in which the patient is submerged.

FINDINGS TO DATE: The core (sublingual) temperature at which the subject begins to sweat has been found to decrease as skin temperature increases. This was known to be true for subjects who increase their core temperature by exercising or by heating the sentient skin surface but has not been previously demonstrated in subjects having insentient skin and/or in subjects who did not exercise or have the skin surface heated.

In future months we will collect more data points from additional subjects and apply a curve fitting analysis to data to obtain a mathematical description of the relationship between core and sentient skin temperature at the onset of sweating or shivering.

APPLICABILITY: Many patients with spinal cord injuries are unable to maintain constant core temperatures since they cannot shiver and sweat very lightly in areas innervated below the level of lesion. These patients often become hypo- or hyperthermic in climates with temperature extremes. The results from this study will assist health professionals in returning these patients to euthermia in the most effective manner. These studies may also be applied to other groups of patients such as heat stroke victims and persons with disturbances in thermoregulation due to administration of anesthetics.

365 Clinical Assessment of Psychological Adjustment to Spinal Cord Injury

Principal Investigator:	Margaret S. Marcus, M.A.	
FY 1976		
Status:	Continuing	
Dates:	April, 1975-June, 1977	
Cost:	Annual $11,585 RT Annual $6,143	Projected Total $20,018 RT % of Annual Total 53%
Annual Report Reference:	#10, Page A-165, R-52	
FY 1977		
Status:	**Continuing**	
Dates:	**April, 1975-December, 1977**	
Cost:	**Annual $13,687** **RT Annual $7,777**	**Projected Total $32,116** **RT % of Annual Total 57%**
Annual Report Reference:	**#11, Page A-183, R-52**	

OBJECTIVES:

1. To pilot-study a recently developed psychological assessment instrument which attempts (a) to quantitatively measure psychological adaptation and (b) to predict whether a patient is capable of a successful psycho-social adjustment to spinal cord trauma.

METHODOLOGY: A multiple-factor psychological assessment instrument measuring ego resilience, internal vs. external locus of control, effective well being and symptoms of stress, patient acceptance of the sick role, future orientation, denial and repression was developed and is being administered to a group of 100 male and female spinal cord injured patients, ages 14-64. The research protocol calls for collection of data within one week of the patient's first rehabilitation center admission, within one week of discharge and at one-year post-injury.

Data from the psychological instrument is tabulated and statistically analyzed. In addition an attempt is being made to correlate the data from the psychological instrument with an appropriate functional outcome measure at each predetermined interval.

FINDINGS TO DATE: A preliminary analysis of data reflects a definite trend in increased functional ability between time of admission and time of discharge. Patients were, as would be expected, more independent in self-care and activities of daily living at discharge than they were upon admission.

Level of function tended to remain constant from discharge to one-year follow-up, although there was fluctuation in both directions. More sophisticated statistical analyses of psychological and functional outcome data will not be pursued until the entire series has completed the three-part testing sequence.

APPLICABILITY: Chronic depression, withdrawal, hostility, anger and denial are all features of any catastrophic illness, especially spinal cord injury. The extent to which these psychological characteristics lead to chronic morbidity and failure of vocational adjustment has not been adequately determined. If the psychological instrument is proven to have predictive ability, patients identified as having "poor adjustment prospects" can be provided additional supportive care early in the rehabilitation program. Early intervention may result in improved adaptation to injury for the patient and hopefully reduce future medical and psycho-social complications which may have adverse ramifications. Improving the potential for successful adaptation to physical trauma has broad and far reaching consequences, particularly with reference to eventual vocational rehabilitation.

366 Energy Expenditure While Performing Normal Street Walking — A Comprehensive Study Using MAMA and Involving Paraplegics, Stroke Patients and Amputees, as well as Normal Subjects, and a Variety of Assistive Devices

FY 1976		
Principal Investigator:	George H. Traugh, M.D.	
Status:	Continuing	
Dates:	January, 1975-January, 1978	
Cost:	Annual $48,657 RT Annual $37,819	Projected Total $161,053 RT % of Annual Total 78%
Annual Report Reference:	#10, Page A-173- R-53	

FY 1977		
Principal Investigator:	**Chi-Tsou Huang, M.D.**	
Status:	**Continuing**	
Dates:	**January, 1975-June, 1978**	
Cost:	**Annual $63,061** **RT Annual $43,755**	**Projected Total $216,188** **RT % of Annual Total 69%**
Annual Report Reference:	**#11, Page A-193, R-53**	

OBJECTIVES:

1. To determine whether a difference in energy expenditure occurs and can be measured when comparing two different means of solving a given patient ambulation or transfer problem.
2. To determine the source of these differences should they be identified.

METHODOLOGY: A mobile automatic metabolic analyzer (MAMA) mounted on a motorized cart with an automatic speed control, capable of following a predetermined path is used to measure certain physiologic parameters during activity. Simultaneous measurements of %O_2 %CO_2, %N_2, %H_2O as well as inspired and expired volumes are acquired. Using gas fractions, volume data and the mathematical technique of indirect calorimetry, true minute oxygen consumption is calculated. All data are reduced to STPD conditions. Energy cost of ambulation calculated from O_2 consumption is then expressed as a function of time, distance or unit weight and body surface area of the subject. All data processing and computation is performed on a PDP 11/40 digital computer.

FINDINGS TO DATE: Previously unsuspected, as well as suspected differences in energy expenditure requirements have been identified in a number of substudies. As anticipated, a "conditioning effect" has been observed among some subjects tested on a serial basis.

In a substudy addressing energy requirements of different artificial prostheses, statistically significant differences have been noted among varying designs.

APPLICABILITY: Results in findings from these and future studies may be utilized in the selection of prostheses and orthoses as well as in the design of new devices. It is anticipated that a direct clinical application will soon be achieved. Findings from nursing substudies will have direct and immediate clinical application since objective data will be available to direct certain nursing practices regarding patient positioning and transfer modes.

Many conventional braces and prosthetic devices are often prescribed in an arbitrary manner. For this reason large amounts of VRS funding is frequently dissipated into devices which are not commonly used by the client/recipient. MAMA provides a quantitative way to assess the true efficiency related to weight and other mechanical factors of these devices and ultimately will result in tremendous savings when inefficient devices are no longer prescribed.

367 Overcoming Disincentives to the Rehabilitation of SSI and SSDI Beneficiaries

FY 1976 Status: Proposed
Principal Investigator: **Samuel L. Stover, M.D.**
FY 1977
Status: **Continuing**
Dates: **June, 1976-June, 1979**
Cost: **Annual $72,065** **Projected Total $238,534**
RT Annual $60,300 **RT % of Annual Total 83%**
Annual Report Reference: **#11, Page A-257, R-55**

OBJECTIVES:

1. To identify, define, examine and document the universe of apparent and obscure disincentives which may be operating among social security beneficiaries as deterrents to the vocational rehabilitation process;
2. To construct a retrospective profile of SSI/SSDI beneficiaries who successfully complete or do not complete a vocational rehabilitation program;
3. To examine the interactive role of apparent, obscure and documented disincentives in the eventual outcome and vocational rehabilitation process among SSI/SSDI beneficiaries;
4. To determine the feasibility of constructing a model capable of simulating vocational rehabilitation outcome responses for selected disincentives;
5. To develop experimental intervention strategies intended to enhance probability of successful completion of a vocational rehabilitation program;
6. To provide descriptive statements supported by objective data which address numerous questions about SSI/SSDI beneficiaries involved in vocational rehabilitation programs who may confront or may be confronted by universal apparent and/or obscure disincentives, each subject to the influence of unique personal characteristics.

METHODOLOGY: Data on disincentives to vocational rehabilitation will be collected in a two-phase project. During phase I, RSA 300 data forms from a multi-state sample will be analyzed to obtain descriptive profiles of demographic and other characteristics which distinguish between SSI and/or SSDI beneficiaries who complete, as opposed to those who do not complete, a vocational rehabilitation program. During phase II of the project successfully and unsuccessfully rehabilitated clients and rehabilitation counselors will be questioned, utilizing a structured interview schedule, about their perceptions of disincentives to vocational rehabilitation. Analyses of the data in conjunction with demographic and other biographic information on both groups of respondents will submit the examination of intergroup differences in processions of deterrents to vocational rehabilitation.

FINDINGS TO DATE: This project has only recently been initiated and no findings are available at present.

APPLICABILITY: The Vocational Rehabilitation Act of 1973 establishes a primary goal of the State/Federal Rehabilitation Program as the "return of disabled persons, when possible, to substantial gainful activity." It is known many severely disabled persons often find it necessary to apply for and receive SSDI and/or SSI benefits during the course of rehabilitation. Under present Social Security law, a recipient who subsequently becomes rehabilitated and ready for employment finds himself in the rather awkward situation of being unable to afford to return to work. Knowledge of the characteristics of clients who are not rehabilitated and disincentives to their rehabilitation is necessary if modification to delivery of rehabilitation services and the mellieu in which they are provided is to be successful.

368 Renal Scintillation Camera Studies as a Method of Following Renal Function and Urological Management in Spinal Cord Injury Patients with Neurogenic Bladder

FY 1976 Status: Proposed
Principal Investigator: **Samuel L. Stover, M.D.**
FY 1977
Status: **Continuing**
Dates: **June, 1976-May, 1981**
Cost: **Annual $334,825** **Projected Total $770,927**
RT Annual $23,827 **RT % of Annual Total 7%**
Annual Report Reference: **#11, Page A-283, R-56**

OBJECTIVES:

1. To compare results of the comprehensive renal scintigraphy procedure (CRSP) and plain film KUB x-rays with the excretory urogram in a series of SCI patients with neurogenic bladder to identify changes in renal function detected by the scintigraphic technique and to correlate these changes with visible anatomic and/or gross functional changes revealed by plain film KUB x-rays and excretory urograms;
2. To compare post-void residual urine volumes measured by renal scintigraphy to volumes obtained by catheterization;
3. To compare results of renal function measured using the CRSP to laboratory measurements of serum urea nitrogen and serum creatinine;
4. To compare abnormalities identified on cystourethrography to functional results obtained using the CRSP and plain film KUB x-rays;
5. To develop and test a predictive model for future urinary tract complications using past and present values of results from the CRSP, excretory urogram, cystourethrogram, plain film KUB x-ray and blood chemistry procedures;

METHODOLOGY: Morphological and functional assessment of the genitourinary system will be performed in a series of spinal cord injury patients with accompanying neurogenic bladder using two diagnostic routines: (1) CRSP and plain film x-rays of the kidneys, uteters and bladder; and (2) excretory urograms, residual urine volume measurements, serum urea nitrogen and serum creatinine determinations and cystourethrograms during the initial hospitalization and/or at regularly scheduled follow-up evaluations. Test results from the two diagnostic routines will be examined to determine the comparability of data derived from various procedures. Regression equations, correlation coefficients and other statistical expressions will be calculated to determine the sensitivity and specificity of each measure.

FINDINGS TO DATE: At present the urological rehabilitation research facility is just being completed. No CRSP studies have been conducted although it is anticipated formal testing will be initiated by mid-May, 1977.

APPLICABILITY: The spinal cord injured patient with neurogenic bladder often has multiple urological complications which may progress to renal failure and death. Of death occurring in spinal cord injury patients, approximately 50% are renal deaths. Urological problems often prolong the disability, require protracted or repeated hospitalization, and may preclude some of these severely disabled patients from returning to vocational pursuits. Improved and less complicated methods for evaluating renal function in these patients should facilitate urologic management, decrease costs of associated hospitalization and allow more continuity of vocational activities as well as prolong the life of the patient.

369 Long-Term Follow-up Studies of Patients with Spinal Cord Injury Who Became Catheter Free Following an Intermittent Catheterization Program

FY 1976 Status: Proposed
Principal Investigator: **Samuel L. Stover, M.D.**
FY 1977
Status: **Continuing**
Dates: **June, 1976-June, 1979**
Cost: **Annual $23,335** **Projected Total $77,237**
RT Annual $7,150 **RT % of Annual Total 31%**
Annual Report Reference: **#11, Page A-325, R-57**

OBJECTIVES:

1. To evaluate long-term renal status and complications among patients who have successfully completed the intermittent catheterization program (ICP).
2. To compare long-term renal status and medical complication findings on catheter-free patients with similar findings from those of patients who never become catheter-free and continue with an indwelling catheter.
3. To evaluate chronic bladder changes on follow-up examination and effects of such changes on upper urinary tract deterioration.
4. To re-evaluate previous literature which suggests ICP followed by a catheter-free state is the ideal method of long-term urinary tract drainage.

METHODOLOGY: An ICP has been in progress for 6 years. All male spinal cord injury patients enter the program unless entry is precluded by specific contraindication. All patients are followed on a long-term basis and studied for morphologic and functional changes in kidneys, ureters and bladder. The protocol utilized pyelocaliectasis as the determinant of upper tract (renal) abnormality. Caliectasis must be present to be considered abnormal. Dilitation of the renal pelvis or ureter without caliectasis is not reported as abnormal. Degrees of pyelocaliectasis are graded according to predetermined parameters.

FINDINGS TO DATE: 126 male SCI patients whose acute bladder management included indwelling urethral catheters have been converted to an ICP with most achieving a catheter-free state. A higher prevalence of pyelocaliectasis has been observed in these patients compared to similar changes in patients upon whom intermittent catheterization was initiated immediately after injury. Right side predominance of pyelocaliectasis has been demonstrated. The extent of neurological deficit (complete or incomplete lesions) does not appear to influence development of pyelocaliectasis. Preliminary findings support the contention that intensive urological follow-up is necessary for all spinal cord injury even though a catheter-free state has been achieved through use of intermittent catheterization.

APPLICABILITY: Since introduction of the ICP at this Center 6 years ago, a large amount of data has been collected on patients who enter the ICP. These data are being analyzed to evaluate long-term effects of catheter removal which is necessary to prove or disprove efficacy of the catheter-free state as the method of choice for bladder drainage in patients with neurogenic bladders secondary to spinal cord injury.

370 Pain in Spinal Cord Injury

FY 1976 Status: Proposed
Principal Investigator: **C. S. Nepomuceno, M.D.**
FY 1977
Status: **Continuing**
Dates: **June, 1976-September, 1978**
Cost: **Annual $15,529** **Projected Total $37,307**
RT Annual $11,499 **RT % of Annual Total 74%**
Annual Report Reference: **#11, Page A-343, R-58**

OBJECTIVES:

1. To characterize pain as it occurs and is described by a series of spinal cord injury patients.
2. To analyze and evaluate these characterizations in terms of psychological, physical and demographic variables on a patient specific and series basis.

METHODOLOGY: Spinal cord injury patients with lesions of at least 12 months' duration were asked to respond to a series of questions about their condition and any associated discomfort/pain. Criteria for inclusion in the study does not consider level or extent of lesion or nature of associated injuries, although the latter variable will be subject to consideration when data are ultimately analyzed.

FINDINGS TO DATE: 200 of 348 questionnaires (56%) were completed and categorized into 4 groups by level of lesion. 160 subjects (80%) reported having experienced pain they believe to be associated with the spinal cord injury. Among these, 78% were male and 22% were female. This near 4 to 1 ratio is reflective of the usually observed sex distribution pattern noted among spinal cord injury patients. Racial distribution was 75% white and 25% black which is also consistent with previous racial distribution data after relative population size has been adjusted with appropriate statistical techniques. Respondents ranged in age from 11 to 76 years ($\bar{X}$ 33 years). Duration since injury averaged 60 months and ranged between 14.5 to 312.0 months. Patients were asked to describe the nature of the pain utilizing a wide variety of objective and subjective descriptors.

Responses to all inquiries contained in the questionnaire have been tabulated and are being analyzed. Previously acquired epidemiologic and behavioral data is being included and all data will be considered in an attempt to identify parameters or variables which significantly influence responses of spinal cord injury patients to the phenomenon of pain.

APPLICABILITY: Information gathered from this study can be immediately utilized by clinicians, therapists, psychologists and vocational counselors in spinal cord injury rehabilitation programs. These data may prove useful to the professional rehabilitation specialist in assessing, evaluating and accurately determining the impact and role of pain as it influences or affects the rehabilitation process. The findings may lend insight into the physical and psycho-dynamic aspects of the phenomenon as it occurs in spinal cord injury and may assist rehabilitation specialists in creating realistic goals for the patient/client.

371 Preliminary Investigation of Micrographic Viewer for Use by Disabled Persons

FY 1976 Status:	Proposed	
Principal Investigator:	**James R. Jackson**	
FY 1977		
Status:	**Continuing**	
Dates:	**June, 1976-December, 1977**	
Cost:	**Annual $11,872** **RT Annual $8,564**	**Projected Total $18,402** **RT % of Annual Total 72%**
Annual Report Reference:	**#11, Page A-367, R-60**	

OBJECTIVES:

1. To determine the potential for developing or modifying an inexpensive microfiche viewing system capable of operation by a severely handicapped individual.
2. To determine and document the quantity and nature of commercially available printed material in microfiche format.
3. To determine desirability of development of the micrographic viewer with large fiche capacity.

METHODOLOGY: A comprehensive list of commercial software sources was acquired and a survey letter was sent to all identifiable sources. Results of the survey were compiled and studied. The necessary material and equipment was determined and acquired followed by construction of the first prototype which is presently in the midst of evaluation and modification. Drawings for a final prototype have been completed and construction is pending. Subsequent to completion of the final prototype, results will be evaluated and compared with a series of commercially available page turners for such characteristics as client acceptability, cost, utility, reliability and amount of assistance required for operation.

FINDINGS TO DATE: Comprehensive catalogs of materials available in microfiche and microfilm from all major and many secondary micro publishers have been acquired resulting in the conclusion that availability of a variety of materials in microform justifies continuation of viewer development. The Kodak "Ektalite 224" micrographic viewer is being used in development of the first prototype. A method of connecting microfiche by using a flexible mylar tape to form a roll has been developed thus allowing maintenance of small roll size while permitting ease in changing rolls.

APPLICABILITY: Successful development of a multi-access microfiche viewing device could impact positively on several aspects of the rehabilitation process. It might help create a sense of independence in the user because selection of a variety of reading materials during reading sessions without second party assistance would be possible. In addition, an economical and reliable device of this nature could be used to expand vocational possibilities of severely handicapped persons by allowing access to large quantities of data.

372 Assessment and Evaluation of Home Health Team Activities

FY 1976 Status:	Proposed	
Principal Investigator:	**Samuel L. Stover, M.D.**	
1977		
Status:	**Continuing**	
Dates:	**June, 1976-May, 1978**	
Cost:	**Annual $30,143** **RT Annual $20,000**	**Projected Total $33,300** **RT % of Annual Total 66%**
Annual Report Reference:	**#11, Page A-375, R-61**	

OBJECTIVES:

1. To examine, assess and evaluate Home Health Team activities including miles traveled, personnel costs, number of patients visited, frequency and regularity of visits, etc. from time of implementation until present.
2. To identify and assess availability of professional and paraprofessional resources throughout Alabama and compare these resources with patient residence locations as reflected by current Spinal Cord Injury Project data.
3. To perform a cost/benefit analysis of Home Health Team activities.
4. To evaluate health status of patients visited and compare this status with a matched cohort who have not been visited.
5. To evaluate, assess and determine the feasibility of expanding both scope and frequency of services to homebound clients by altering activities from direct patient care to teaching of professionals and paraprofessionals who will be responsible for providing patient care in the county or region.

METHODOLOGY: The methodology is that of a classical administrative/management analysis (detailed fiscal analyses, evaluation of duties, time in field, medical conditions treated, total cost, etc.). A stratified random sample of former Spinal Cord Injury Project patients who are seen by the Home Health Team will be evaluated for health status, complications, hospital readmissions, etc. A statistical analysis of these findings will be completed.

FINDINGS TO DATE: The Home Health Team related cost per spinal cord injury patient on Home Health Team rolls has declined steadily since 1973. The annual cost per patient, both active and inactive, was determined to be $94. Data revealed a cost per visit reduction occurring between 1972 and 1974 with an insignificant increase in 1975 and 1976. The overall cost per patient visited throughout lifetime of the project is approximately $160. A systems analysis of Home Health Team activities suggests a well run and reasonably efficient operation with an apparent saturation point having been reached. These data suggest that a team operating in a similar geographic/demographic "environment" could conduct approximately 275 visits annually if in the field two days per week, 50 weeks per year.

APPLICABILITY: Findings from this study will assist other rehabilitation centers in determining whether similar activities are economically feasible and cost-effective modalities for providing on-going follow-up care for spinal cord injury patients as well as other severely disabled persons.

373 Linguapalatal Cues as an Aid to Consonant Articulation in Deaf Adults

FY 1976 Status	Proposed	
Principal Investigator:	**Samuel G. Fletcher, Ph.D.**	
FY 1977		
Status:	**Continuing**	
Dates:	**June, 1976-June, 1977**	
Cost:	**Annual $34,927** **RT Annual $25,000**	**Projected Total $37,815** **RT % of Annual Total 72%**
Annual Report Reference:	**#11, Page A-393, R-62**	

OBJECTIVES:

1. To instrumentally document linguapalatal contact patterns during utterance of words with sounds such as "t," "s," and "k" that are not normally visible during speech.
2. To provide visual feedback to the speaker, to improve his speech production patterns.

METHODOLOGY: The instrumental device used in the study is the palatometric component of the PAGIS system capable of detecting linguapalatal contacts with electrodes embedded in a thin plastic pseudopalate which adheres to the speaker's hard palate. Acoustic output during speech is monitored with a spectrum analyzer. Data are acquired under on-line control of a PDP 11/40 computer and written on magnetic tape for processing and viewing. A 500 point LED display with appropriate circuitry is utilized to identify tongue to palate contact points. The speaker is notified, visually, of the linguapalatal contact pattern any time one of 96 sensors is touched. The LED display is used as a primary feedback source to assist the speaker in recognition and change of articulation patterns. Proof of advantages achieved by physiologically derived data is obtained by comparison with results from acoustically derived data. A scan converter is used with a currently available 32-channel spectrum analyzer and video monitor. This enables generation of near real time "voice prints" of the subject's speech output.

FINDINGS TO DATE: Speech behavior as reflected in preliminary data has demonstrated a rapid rate of improvement. The "t" sound introduced in a third session was maintained in a variety of nonreinforced contexts during subsequent treatment sessions. Phoneme intelligibility has increased. Articulation of the "t" sound and its voice cognate "d" improved dramatically. (Note: No significant attention was given to the "d" cognate.) Observed improvement appears to demonstrate rapid transfer of the plosive alveolar place of articulation. Less dramatic changes in phonemic intelligibility is shown for the sibilant "s" and its voice cognate "z". Words chosen in the pretest evaluation had a wide variety of sounds substituted for the "s." Word intelligibility also showed improvement. In the pretest 17 (2.4 percent) of 700 possible words were identified correctly while in the post-test 23 (3.3 percent) were also identified. Although not analyzed statistically, this change appears too small to be significant. Preliminary results must be interpreted cautiously. It is unknown how much of the improvement would have been obtained through more traditional approaches. The ease with which the subject perceived differences in sounds and was able to alter the place of articulation was felt to be particularly promising.

APPLICABILITY: The greatest single vocational obstacle faced by deaf speakers is the acquisition of usable articulate speech. The present study has been designed to attack this fundamental problem through use of an instrument system which provides information directly related to articulation of sounds that are not perceptible through lip-reading. Use of this information may be expected to enhance speech production of deaf speakers and thereby markedly improve their prospects for more adequate speech and vocational rehabilitation.

Northwestern University (RT-20)
Medical Rehabilitation Research and Training Center

CORE AREAS

Neuromuscular Studies Unit

To improve clinical management of neuromuscular dysfunction through development of advanced techniques in diagnosis and understanding of cause and control of neuro motor disturbance.

Rehabilitation Services Evaluation Unit

To improve management and delivery of rehabilitation services through evaluative feedback of programs, procedures and devices constituting the rehabilitative process.

Spinal Cord Injury Rehabilitation Studies

To develop new knowledge through multidisciplined research which will lead to prevention of medical complications, maximize physical and psychologic function and increase resocialization and vocational achievement of the spinal cord injured.

Behavioral Studies Unit

To improve human performance of the physically disabled through new understanding of the behavior of the disabled individual, significant others and the providers of rehabilitative assistance.

NORTHWESTERN UNIVERSITY

Henry B. Betts, M.D., Director
Northwestern University Medical
Rehabilitation Research and Training Center
Rehabilitation Institute of Chicago
345 East Superior Street
Chicago, Illinois 60611

PROJECT TITLES BY FY 1977 STATUS

COMPLETED

Abstract No.

Functional Achievement Evaluation: RIC Tenodesis Splint (Beverly Ritt, B.S., O.T.R.) 375

Health Services for Developmentally Disabled Adults (H. Betts, M.D.) 376

Reducing Public Barriers of the Severely Handicapped (G. Albrecht, Ph.D.) 377

Survey of Comprehensive Medical Rehabilitation Centers Serving the Most Severely Handicapped (G. Albrecht, Ph.D.) 378

The Role of Neurotransmitters in Spasticity Genesis (V. Sahgal, M.D., M.S.) 379

Rehabilitation Follow-up Program (B. Hamilton, M.D., Ph.D.) 380

Day Care Pulmonary Rehabilitation Program Evaluation (B. Shapiro, M.D.) 381

CONTINUING

Electromyographic and Cystometrographic Study of Human Bladder (P. Kaplan, M.D.) 382

Conceptual Model of Planning and Evaluation of Rehabilitation Services (Former Title: Conceptual Model of Planning and Management of Rehabilitation Services) (S. Harasymiw, Ph.D.) 383

Rehabilitation Information System (REHABIS) (S. Harasymiw, Ph.D.) 384

Prevention of Urinary Tract Infection in Spinal Cord Injury (Y. Wu, M.D.) 385

NEW

The Natural History of Deep-Vein Thrombosis in the Spinal Cord Injured (James Yao, M.D., Ph.D.) 386

Vocational Follow-up of the Physically Restored Unemployed
(R. Sakalas, M.S.) 387

DISCONTINUED

Pressure Ulcer Prediction and Prevention: A New Procedure (M. Matson, B. S.) 374

OTHER

Measurement of Rehabilitation Success: Who Sets the Criteria (G. Albrecht, Ph.D.)

Histochemical Study of Human Muscle Spindles: Spasticity (V. Sahgal, M.D.)

The Role of Neurotransmitters in Spasticity Genesis: Response to Reserpine
and Nialamide (V. Sahgal, M.D.)

PROPOSED

Post Rehabilitation Problems and Costs (S. Harasymiw, Ph.D.)

Rehabilitation Functional Gain Per Unit Cost (S. Harasymiw, Ph.D.)

374 Pressure Ulcer Prediction and Prevention: A New Procedure

Principal Investigator: M. Mattson B.S.
FY 1976
Status: Continuing
Dates: June, 1975-October, 1976
Cost: Annual $1,035 Projected Total $2,200
RT Annual – RT % of Annual Total –
Annual Report Reference: #8, Page 33, R-6B

FY 1977 Status: **Discontinued**

OBJECTIVES: The short range goals of this study are:

a. To test a measuring system which can quickly and reliably measure the blood flow in an area of skin.

b. To explore the effect of pressure on skin blood flow.

c. To determine whether the skin blood flow response to pressure varies between spinal cord injured patients and a control population.

The long range goals of this study are:

a. To identify parameters which could be used to select highly susceptible patients, with regard to skin pressure ulcer.

b. To develop a clinically useful measuring system able to identify vulnerable patients and skin areas.

METHODOLOGY: Study population – two groups were examined:

a. A control group of five uninjured individuals (no sensory or motor deficits). This group was tested at two experimental pressures.

Temperature measurements were measured directly, as the relationship between blood flow and temperature was assumed to be direct, to a point. Temperature was measured with two "Uni-Curve" thermisters.

Each subject was appropriately positioned in the testing room; the "reference thermister" was taped in place; the system was allowed to come to temperature equilibrium. The sandbag weight was suspended from the hook raising the pressure on the skin under the thermister. After the five minute test pressure exposure, the weight was removed.

The skin of the test site was examined after removal of the thermister and 24 hours later to check for evidence of ulceration (none ever occurred at the pressure and duration tested).

FINDINGS TO DATE: It can be said that the project has met its short-range goals well. The device constructed has been shown to be simple to use and quite reliable. Some differences in response have been shown between quadriplegics and controls. The confusing factor of the tourniquet effect of the previous pressure inducing method has been eliminated, but other knotty questions have been raised. Why does the temperature rise when pressure is applied? If the pressure were raised, would the previous curve develop? What is the mediator of the response? Thus, the project can be pursued on three levels: toward implementation of the procedure in the clinical setting, exploring the response at other pressures, and biochemical studies of the microvasculature. The progress has been significant, but the development is by no means complete.

APPLICABILITY: The basic data and method when definitively developed should be useful in clinical research on skin and tissue blood flow response to pressure. Also, the clinical use implication is in identifying, early, patients with high risk of skin pressure ulcer, the likely sites of future ulceration, and finally, preventing such ulcers from forming.

Such applications must await further development of the project. The potential is significant.

375 Functional Achievement Evaluation: RIC Tenodesis Splint

Principal Investigator: Berly Ritt B.S., O.T.R.
FY 1976
Status: Continuing
Dates: November, 1970-March, 1976
Cost: Annual $16,797 Projected Total $16,797
RT Annual $16,797 RT % of Annual Total 100%
Annual Report Reference: #8, Page 47, R-8A

FY 1977
Status: **Completed**
Dates: **November, 1970-March, 1976**
Cost: **Annual –** **Projected Total $16,797**
RT Annual – **RT % of Annual Total –**
Annual Report Reference: **#9, Page 33, R-8A**

OBJECTIVES: The objectives for this segment (R-8A) of the overall project are:

1. Evaluate the RIC tenodesis splint in terms of the evaluation matrix developed (Project R-8) by Rizzo, et al.
2. Test some of the assumptions and underlying current concepts in tenodesis splint prescription and evaluation.
3. Generate, for use by clinical and research-development staff, recommendations which will improve the rehabilitation process directed at maximizing hand function in quadriplegics; with regard to selection of patients, fabrication and fitting, training of patients, and follow-up maintenance of the RIC tenodesis splint.
4. Disseminate findings and recommendations to relevant clinicians and researchers.

METHODOLOGY: The research design originated from the orthotics research evaluation framework developed by Rizzo. The framework was modified to include four rehabilitation goals in order to facilitate evaluation. The goals were: I. Prehensile function, II. Hand function, III. ADL function and IV. life function. Five hypotheses were developed and tested based on the study's objectives and the evaluation framework.

In order to assess the criteria "effort" and "process," five major questions were asked.

The study population was selected from RIC medical records with the following selection criteria: (1) RIC inpatient between 1960-1975, (2) diagnosis of traumatic quadriplegia, and (3) received a definitive RIC tenodesis splint.

The three instruments used in this study were: questionnaire, observation, and survey of therapists.

FINDINGS TO DATE:

1. The definitive RIC splint was beneficial and is still being used by a small population over a period averaging 5.5 years.
2. Two predictive variables for splint use were indicated: prehension force and amount of opening **without the splint.** Further research is required to find the exact scores and cut off points. In general, the naturally weaker hands belonged to the subjects who used the splint.
3. Main value of RIC splint may be as a temporary training device. Many patients said that the splint was beneficial initially but that they quickly progressed to a level where they no longer needed the splint. Most of non users agreed the splint gave them a good understanding of how to use the natural tenodesis action of own hand and increased their confidence in using their hands again. Perhaps the attitude should be that the splint is just a temporary aide until the client finds an easier, faster way of doing activities with splint. A $30 mockup splint will be sufficient for this – after a year if the patient wants a splint, then order a definitive one.
4. Alternative methods of splint use should be emphasized more in training quadriplegic hand function.
5. The Rizzo Evaluation Framework is valid at all levels tested except the life function level.
6. Frequency of use, per se, is not an adequate indicator of the splint's functional utility.
7. Three point prehension is not necessary for ADL performance.
8. Splint assisted prehension made a significant increase of performance in only one area – force of prehension.
9. Basically people don't like devices. They prefer to survive with what they have.
10. Need more orthotic research done with theoretical and statistical approach so one can better evaluate and compare the variety of orthoses available across the nation. Areas for further exploration might be:
    a) functional use of splints
    b) value of consistent training program
    c) durability or flexibility of various materials
    d) maintenance required over long period of time
    e) effective way to increase function and decrease cost.

APPLICABILITY: The rehabilitation team can well use the data obtained by this study to improve guidelines for patient evaluation, prescription, training, and follow-up, as well as design and maintenance related to use of splints in general and the RIC tenodesis splint in particular. Hand function is essential in life function, particularly in achieving independence in activities of daily living and productive work. For quadriplegics, possibly the most severely disabled individuals, hand function becomes critical because there is little useful movement elsewhere in the body. Without a functional hand, a quadriplegic is virtually totally dependent.

The "evaluation matrix of functional achievement" developed as a theoretical framework for this study can serve as a guideline for future functional assessments of other orthodeses and adaptive equipment.

The methods and results of correlations between splint use, frequency and performance at the three functional levels will be useful in future orhotics research.

376 Health Services for Developmentally Disabled Adults

Principal Investigator:	H. Betts, M.D.	
FY 1976		
Status:	Continuing	
Dates:	August, 1972-February, 1976	
Cost:	Annual $8,125 RT Annual $8,125	Projected Total $165,000 RT % of Annual Total 100%
Annual Report Reference:	#8, Page 78, R-26	
FY 1977		
Status:	**Completed**	
Dates:	**August, 1972-June, 1976**	
Cost:	**Annual –** **RT Annual –**	**Projected Total $165,000** **RT % of Annual Total –**
Annual Report Reference:	**#9, Page 76, R-26**	

OBJECTIVES: To identify the characteristics of the target population and of the existing medical and allied health delivery systems serving substantially handicapped adults with developmental disabilities in the urban universe generally described at the city of Chicago.

The overall objective of this study has been to identify the characteristics of the target population and of the existing medical and allied health delivery systems serving substantially handicapped adults with developmental disabilities in the urban universe generally described as the Chicago metropolitan area.

METHODOLOGY:

A. Definition of study population: the substantially developmentally disabled adult is an individual sixteen years old and above, who through birth and development has some physical and/or mental disability and who is in need of multiple services over extended periods of time.

B. Universe description: study universe has been the city of Chicago. The metropolitan Chicago population is 6.8 million.

C. Survey and evaluation methodology:

1. Operations structure: Surveying the universe and evaluating its developmentally disabled population and health servicers has been operationally approached by three study units: a. Consumer Identification Unit; b. Consumer Evaluation Unit; c. Health Services Identification and Evaluation Unit.
2. Method of identification of the developmentally disabled population and the health services serving this population. Briefly, the strategy has been to generate a list of health services providers which serve the developmentally disabled population. From the providers, a primary list of developmentally disabled consumers has been identified. Additional consumers not identified by this system have been solicited by media advertisement, basically.
3. Data Base. a. Health Providers Services, b. Consumers.

The basic approach to achieve project objectives has been by identification and then evaluation of DDA consumers and service providers.

Identification procedures identified about 3,800 potential DDA consumers (roughly 2% of estimated DDA consumers) and 1,400 potential DDA service providers (roughly 90% of their major service providers).

From these two primary "lists" the five evaluation cohorts were generated.

The Consumer Survey Cohort (n=625)
The Consumer Validation Cohort (n=202)
The Consumer Clinical Evaluation Cohort (n=124)
The Provider Survey Cohort (n=617)
The Provider On-Site Evaluation Cohort (n=55)

Evaluation. Evaluation methodology focused on both a consumer and provider cohort.

FINDINGS TO DATE: This study identifies the characteristics of the substantially handicapped developmentally disabled adult (DDA) population and the existing medical and allied health delivery system serving this population in the Chicago metropolitan area.

There are up to 122,000 developmentally disabled adults with mental retardation, cerebral palsy and/or epilepsy in the Chicago area. The mean age of the study population was 30 years; 9 per cent were competitively employed; 91 percent had income below poverty level; 63 percent were living at home with their parents; 88 percent had never been married.

Of the total numbers of identified health, education and welfare problems of the DDA sample, 70 percent were categorized as physiological and 30 percent social-environmental; 32 percent involved disability in communication, mobility or activities of daily living.

Of the existing problems, 62 percent were considered treatable today and **42 percent could have been prevented** or improved to the point where current treatment would not be necessary.

The greatest **unmet service need** for the DDA was for transportation, vocational training/placement, financial aid, residential placement, information-referral and education, in that order. There appears to be a maldistribution of services for the DDA in some southside Chicago communities.

A major problem appears to be **lack of awareness** by consumers and providers of where the developmentally disabled can go for a continuum of integrated and timely services.

APPLICABILITY

A. A Products: Data concerning the location and type and extent of medical-social problems of developmentally disabled adults; type and extent of health services received and required by adults with substantial developmental disabilities in a large urban universe; a registry of DD services which should be used as the basis of a referral network for community services by DD consumers and providers.

B. Expected Users of Products and Use: The federal, state and local program planners who are charged with responsibility of implementing the Developmental Disabilities Act need the information and descriptive data this project will provide so that new policies or new legislation can be formulated or enacted to expand existing medical and allied health services where necessary, or institute new programs where there are none. In particular, the state of Illinois Department of Mental Health and Developmental Disabilities, the authorized agency that implements the Developmental Disabilities Act in this state, will be a specific user of project output. It is expected that this project output will implement the Developmental Disabilities Act of 1970. The implication could affect services delivery in the Chicago Metropolitan area and nationally.

Major Recommendations:

1. A service delivery model based on the **problem-solving concept** and consisting of elements of AWARENESS, AVAILABILITY, ACCESSIBILITY, EFFECTIVENESS and COORDINATION of services.
2. A continually updated and widely disseminated **REGISTRY OF SERVICES** in the community specifically for the developmentally disabled.
3. Trained **COORDINATORS** of DD services, each multi-disciplined and readily identifiable and locatable.
4. Publication and dissemination of alternative sources and procedures for obtaining DD service FUNDING.
5. Reduction of TRANSPORTATION and ARCHITECTURAL BARRIERS for the mobility-limited through enforcement of existing legislation, reduced costs for transportation and more accessible vehicles and routes.
6. **Earlier,** appropriate VOCATIONAL TRAINING for the developmentally disabled.
7. Better service FOLLOW-UP and evaluation of service outcome.

377 Reducing Public Barriers of the Severely Handicapped

Principal Investigator	G. Albrecht, Ph.D.	
FY 1976		
Status	Continuing	
Dates	June, 1974-March, 1976	
Cost	Annual $18,559	Projected Total $30,538
	RT Annual $13,416	RT % of Annual Total 72%
Annual Report Reference	#8, Page 84, R-30	
FY 1977		
Status:	**Completed**	
Dates:	**June, 1974-March, 1976**	
Cost:	**Annual –**	**Projected Total $37,939**
	RT Annual –	**RT % of Annual Total –**
Annual Report Reference:	**#9, Page 78, R-30**	

OBJECTIVES: This research examines the relationships between stigmatization and helping behavior. It asks the basic question: will an able-bodied individual help a physically disabled person in a public place? Secondly, it examines the set of situational variables that may affect the direction and strength of this helping relationship. The major objectives of this study are:

1. To determine the relationship between one individual's visible disability (stigmatization) and helping behavior on the part of the able-bodied.
2. To ascertain the effect of different demand characteristics and requests for help by the physically disabled on the helping responses of the able-bodied.
3. To describe and characterize the effect of an unanticipated stressful event on crowd behavior.
4. To assess the impact of the disabled individual's visible handicap, sex, and race upon the able-bodied helping response.
5. To utilize videotaped accounts and the data generated in this study to assist the physically handicapped in the unanticipatory socialization process of preparing for re-entry into public life.

METHODOLOGY:

1. This project was set up following a literature search which indicated that an able-bodied individual attaches a stigma to the visibly physically handicapped and acts due to that stigma in a nonresponsive uncomfortable, inhibited, and overly controlled manner.
2. In order to measure the primary dependent variable, degree of helping behavior, a situation was created involving a wheelchair bound person attempting to negotiate curbs from various parts of a sidewalk. This was a demand situation requiring that someone give aid to this individual.
3. In addition to helping behavior, verbal interchange, physical gestures, physical contact, and other types of behavior exhibited by those helping or not helping were considered as dependent variables. The independent variables were movement or no movement of the wheelchair and the section of the sidewalk where the wheelchair is trying to negotiate the curb. Various demographic factors relating to the crowd around the wheelchair bound person were also recorded.
4. All action was videotaped and all helpers or non helpers were administered a questionnaire by an interviewer.
5. The data collected was coded into categories of helping behavior. In addition, the ability to measure physical distance was determined and overt physical behavior was studied in terms of pattern probability. All the data was statistically analyzed by a computer.

FINDINGS TO DATE: Findings from this research suggest that visible disabled persons will be helped in public places: the subject did not have to wait more than about four minutes for assistance. The able-bodied public has positive attitudes toward the physically disabled and there are no attitudinal differences between helpers and non-helpers. Attitudes were not good predictors of length of time to receive help but a few select attitudes were able to help discriminate between helpers and non-helpers.

Although the public has very positive attitudes toward the physically disabled, these able-bodied people have little concrete knowledge of the specific needs, realistic expectations, and capacities of the physically disabled. In this study **attitudes were not good predictors of knowledge or behavior.**

The length of time to receive help was predicted by the curb position and degree of agitation of the paraplegic subject in conjunction with crowd density and verbal initiation of social interaction by the helper. Crowd density was by far the strongest explanatory variable. Being helped in this contest is largely a function of opportunity. These results differ from other studies of crowd behavior which show crowds to inhibit behavior. A visibly disabled person in need will receive help quickly in a crowd even if he does not ask for it.

Perceptions by the helper that the disabled person wants and needs help and being male (respondent) were powerful discriminators of the helping group. The helpers' definition of the situation and physical capacity to respond were the factors most likely to predict helping behavior. On the other hand, some of the interview material suggest that the public experiences difficulty in trying to determine if a disabled person wants help. Furthermore, though the able-bodied persons have positive attitudes toward the disabled, they lack sufficient knowledge to be able to deal with the disabled effectively. Therefore, **the public does seem to need cues in order to respond to the disabled person in need.**

These findings imply that the disabled person can exercise considerable control over his environment. He can control the relationship between the disabled and able-bodied. This can have significant implications for rehabilitation counseling programs. With the appropriate guidance and teaching, the disabled can be more functionally independent in the urban environment through their own management of interaction with the public.

APPLICABILITY: The information and use of the audio-visual device can be instituted in the rehabilitation program of patients at an appropriate time in order to provide a realistic view of the outside physical environment and what type of attitudes to expect of the general public. The clinical staff decision to include this procedure in the patient care program will await evaluation of its impact on attitude and behavior change of patients.

The information to be generated in this project can be useful to RSA for public education in order to achieve service goal V, "Reducing Barriers." Congress can be aided to design legislation improving the Rehabilitation Act with regard to applied research in desired social change. The results show the effects of physical barriers and transportation dependency on the disabled.

Also with project information and the videotape, efforts can be made to persuade local governments to allow easier mobility of the handicapped by providing sidewalks with "curb cuts" in them on every corner. As noted previously, ACCESS CHICAGO, can and will use the project output for these change purposes.

378 Survey of Comprehensive Medical Rehabilitation Centers Serving the Most Severely Handicapped

Principal Investigator:	G. Albrecht, Ph.D.	
FY 1976		
Status:	Completed	
Dates:	June, 1975-December, 1975	
Cost:	Annual $39,479 RT Annual $34,339	Projected Total $39,479 RT % of Annual Total 87%
Annual Report Reference:	#8, Page 112, R-35A	

OBJECTIVES: The specific objectives of this study are:

1. Define and characterize IMSH, distinguishing them from other handicapped individuals with regard to various demographic, epidemiological, and functional factors;
2. Document the type and amount of functional gain that occurred during the inpatient rehabilitation treatment and two and one half year follow-up portions of the study.
3. Identify the services utilized and needed by the IMSH in the rehabilitation process;
4. Identify the individual and treatment variables that predict functional gain over time;
5. Identify the major barriers to functional independence experienced by the IMSH;
6. Assess the impact of severe physical disability on the individual and his family; and
7. Develop and test sensitive measures of function and performance.

METHODOLOGY: In this study, the specific measurement of functional performance level was the primary indicator of severe disability. Physical and social performance were measured at three points in time: time 1, admission to the CRMC; time 2, discharge from the CMRC; and time 3, at follow-up approximately thirty months post discharge. Two scales were utilized to measure physical function: (1) The Barthel Index developed by Mahoney and Barthel (1965) and modified by Granger (1973). (2) The PULSES Profile scale developed by Moskowitz and McCann (1957) and modified by Granger (1973). Additional indicators were used to measure other aspects of physical and social functioning such as ability to stoop, bend and kneel, cost of care, social environment and service utilization. These data were collected in the standard instrument package used in the study.

The IMSH subjects for this study were drawn from the inpatient populations of ten CRMC's located across the United States.

The sample for the study is, therefore, a cluster sample of the severely disabled patient population of the participating CMRC's. The sample represents those persons who were the most severely disabled at the time of their first admission to the CMRC and is not intended to be representative of the total institutional population or of the entire national population of individuals who are not disabled. The total sample size is 307.

FINDINGS TO DATE: The data collection was completed in April, 1975; preliminary analysis completed by June, 1975; data editing and regression and correlation analysis completed by September, 1975. The results of the analysis are presented below.

This sample of the most severely disabled individuals differed in many respects from these other surveys. The IMSH sample was well-educated, predominantly white, relatively equally divided between males and females, and with a high household income. Neurological disorders such as hemiplegia, paraplegia or multiple sclerosis accounted for 82 percent of the sample.

In general, the IMSH moved from categories to severe dependence at admission, as measured by both PULSES and Barthel indices, to that of moderate dependence at time of discharge and follow-up. However, the difference in level of physical function by disability category is most apparent. Those with neurological disabilities are more functionally limited than those with musculoskeletal disabilities or amputations at any point in time.

Contrary to expectations, most families appear to be minimally disrupted by the onset of disability of one member.

The IMSH are not socially isolated, although the number of social contacts per month is much higher than the number of social activities.

The major needs of those working were centered around transportation, physical accessibility to the work setting, and the need for light work. The needs of those not working were similar but more compelling. Those not working also reported a greater need in personal assistance.

A mean of 14 days of hospitalization were required in the last year as a result of a disability related problem.

An average number of 2 types of health care services excluding hospitalization were utilized by the IMSH in the last year, according to the health care service index.

The mean total cost of the rehabilitation inpatient care at the CMRC for the admission studied was $7,635. The average cost of outpatient services for the IMSH during the last year was $1,886. The average annual cost of nonmedical expenses for the total sample was $1,529.

APPLICABILITY: This study can be directly utilized by the Federal government for purposes of planning, programming, and funding future services for the most severely handicapped. In particular, the future scope of the Vocational Rehabilitation program could be based on findings of this study. Congress and the administration are the anticipated primary users of this research information. The policy implications of this study are the most important facet of it. Legislation for the most severely handicapped are, what services they benefit from and what the projected costs for these services will be.

The CSNS and CMRC survey report can be utilized by many in the field of rehabilitation. It will provide a comprehensive data base from which policy makers and health professionals can evaluate and plan comprehensive services.

Another utility of the study is its immediate relevance to service delivery. All participating CMRC's will receive summary data regarding outcome of their patient populations. Seven of these CMRC's are Research and Training Centers. This information can be fully utilized for evaluation of their rehabilitation process and its outcome.

379 The Role of Neurotransmitters in Spasticity Genesis

Principal Investigator: V. Sahgal, M.D., M.S.
FY 1976
Status: Completed
Dates: January, 1975-December, 1975
Cost: Annual $41,696 Projected Total $41,696
RT Annual $4,226 RT % of Annual Total 10%
Annual Report Reference: #8, Page 167, R-38

OBJECTIVES: The objectives of this study have been to critically review the literature in reference to this subject and to present new data concerning the alteration of neurotransmitters following spinal cord injury and relation of these changes to onset of spasticity in experimental animals.

METHODOLOGY: Twenty white rats were employed in the present study. All experimental animals were anesthetized with 1-.15 ml of Nembutal. In 16 rats, a laminectomy was performed at the level of the upper thoracic (T-6 level and the spinal cord was transected. Eight rats served as controls. The animals were killed 1, 3, 5 and 8 days after transection by means of intracardiac puncture to eliminate extensive bleeding into the spinal cord. Parts of the cervical, thoracic, and lumbar spinal cord were removed and frozen in Isopentane cooled with liquid nitrogen at −160°C. Tissues were then transferred to a Vir Tis Freeze Dryer (Model 10-800) and dried for three days at temperatures of −60°C and a vacuum of 5-10 microns. Tissues were treated with formaldehyde vapor for two hours at 65% humidity and then infiltrated with paraffin for 20 minutes in a vacuum oven at 30 pounds of pressure. The blocks were embedded in paraffin, stored in darkness, desiccated and sectioned (8 to 10u). Sections were mounted for fluorescence microscopy and were viewed with the Zeiss Photo-microscope II. Slides were made using High Speed Ektachrome film.

Sections of cervical, thoracic, and lumbar spinal cord were made of all rats and stained for cholinesterase activity according to the method of Koelle and Friederwall. Nissl, Luxol Fast Blue and H&E stains were also made on all sections to ascertain the general morphological integrity.

All animals were neurologically evaluated every 24 hours. A sensory examination using pin-prick was used to ascertain the level of the lesion. The state of flaccidity or spasticity following transection was evaluated by observation of the rat's gait or spontaneous movement, by passive motion of the extremities to monitor tone and rigidity, and by eliciting monosynaptic and polysynaptic reflexes.

FINDINGS TO DATE: In the present study, in the normal spinal cord of rat catecholamine fluorescence was observed in the anterior and lateral funiculi of the white matter throughout the spinal cord. In the gray matter highest accumulation of fluorescent fibers was seen in the intermediolateral column of the thoracic cord. At other levels, that is cervical and lumbar, maximal fluorescence was seen in the internuncial regions while in the ventral horn cells both green and yellow fluorescence was observed. This fluorescence was most prominent in the cervical and lumbar regions. Very little fluorescence was observed in the posterior gray zone.

Our results show that after complete transection of the thoracic cord the rat for the first 24 hours is in a state of spinal shock as evidenced by flaccid paralysis and loss of all sensations. This stage is followed 3 days later by a stage of flexor recovery manifested initially by mass reflex and later on by lateralized withdrawal. After two weeks the animal behaves like a typical spinal animal showing spasticity, placement reactions, skeletal deformities, and automatic bowel and bladder function.

Corresponding to the above clinical state 24 hours after transection, there was marked increase in fluorescence at lesion level (absent on saline perfusion) while below the level of the lesion the distribution remained normal. The cholinesterase distribution pattern showed a decrease in the activity of this enzyme at the level of the lesion and normal pattern below. This indicates that the stage of spinal shock might be related to this marked increase in catecholamines possibly blood element derived.

With the passage of time, (72 hours) below the lesion the catecholamine **fluorescence begins to decrease** and spasticity begins to set in. As time passes, up to three weeks in our studies the catecholamine fluorescence virtually disappears and the animal clinically shows evidence of spastic paralysis. Cholinesterase activity, however, showed a decrease only at the level of the lesion where a prominent gibbus was observed, while below the level of the lesion the distribution was normal. Indicating lower motor neurone lesion at the site of transection.

The decrease in catecholamine fluorescence over a period of time after spinal cord transection has been previously observed by Carlsson et al (1963) and our observations correspond to theirs.

Correlating the clinical neurological profile of the animal with the catecholamine distribution and cholinesterase activity indicates that a monoamine and quarternary amine interaction is important for normal motor function. Our study suggests that a decrease of catecholamine in the presence of normal cholinergic activity might form the pharmacologic basis for spasticity after spinal transection.

APPLICABILITY: The utilization of research results will involve physicians and scientists in medical and comprehensive rehabilitation medicine centers. The impact of research results will involve physicians and scientists in medical and comprehensive rehabilitation medicine centers. The impact of the utilization of the data will be that the foundation has been broadened in understanding the relationship of neurotransmitters and spasticity; adding these informational building blocks will allow research decisions to be made about cause and development of effective agents to prevent or control spasticity in the rehabilitation setting.

380 Rehabilitation Follow-up Program

Principal Investigator:	B. Hamilton, M.D., Ph.D.	
FY 1976		
Status:	Completed	
Dates:	June, 1974-March, 1975	
Cost:	Annual – RT Annual –	Projected Total $3,277 RT % of Annual Total –
Annual Report Reference:	#8, Page 195, R-41	

OBJECTIVE: For a comprehensive medical rehabilitation Center to determine, with regard to a patient follow-up program: a) what should such a program achieve? b) How can such a program be developed, implemented and maintained in order to achieve the desired goal and objectives (only the first objective is being dealt with in the current project). In order to determine program goals and objectives two questions are asked: a) who should determine the goals and objectives? b) How are the goals and objectives to be determined?

METHODOLOGY:

1. Representatives of each clinical department (providers of medical services), including one or more physicians, will identify patient follow-up goals and objectives and rank them in order of importance.
2. A selection of discharged patients (consumers of medical services), representing a variety of medical diagnosis and disability categories, will identify and rank those patient follow-up goals and objectives they consider important for an institution, like RIC, to have.
3. The Delphi methodology, developed by the Rand Corporation, will be used to determine and rank the goals and objectives. The Delphi methodology allows the opinions of many individuals to be solicited and then to be ranked in relative order of importance. It is a method of reaching group consensus.

FINDINGS TO DATE: The rehabilitation staff ("providers") Delphi has been completed. The discharged patient ("consumer") Delphi is in process.

The five highest ranking provider goals identified are: establish a referral network for patients to be followed; examine vocational questions to improve employment opportunities for patients; establish working communication among RIC, patient and family agencies; improve staff-patient interaction, and; assess patient's physical status past discharge.

The five highest ranking objectives identified are: 1) recommended specific facilities for patients and offering adequate follow-up care to discharged patients to ensure that all services are provided; 2) encourage patients and family to handle as many problems as they can themselves; 3) see that all patients with vocational/educational potential achieve it; 4) project team concept into community; 5) document problems patients have after discharge regarding supplies and equipment.

With regard to the Consumer Delphi 15 discharged patients are participating. They have identified 10 goals and 37 objectives. These are not ranked yet. However, when the Consumer Delphi is complete it will be combined with the Provider Delphi to generate a composite goal/objective list. From this list a Follow-Up Program Development Group will develop the implementation strategy for the program.

APPLICABILITY: A comprehensive patient/client follow-up program is probably the most adequate way of assuring that, and determining whether rehabilitation has actually occurred; where it has failed, and what the problems are. Such an evaluative tool must be applied to the rehabilitation process if accountability is to be achieved. This project is directed at providing a meaningful set of operating objectives for such a follow-up program in a major VR support facility.

An important segment of this project has been formal, planned input provided by **severely disabled adult consumers;** fourteen such consumers were involved, although not actually served or involved in an experimental procedure.

The results of this project will be utilized by the staff of the Rehabilitation Institute of Chicago in planning and implementing a patient follow-up program. In this regard the RIC Follow-Up Nurse (Ms. Kennan) has utilized [illegible]ected results in planning expansion of her follow-up data and service program.

381 Day Care Pulmonary Rehabilitation Program Evaluation

Principal Investigator:	B. Shapiro, M.D.	
FY 1976		
Status:	Completed	
Dates:	November, 1971-March, 1975	
Cost:	Annual $2,461 RT Annual $2,461	Projected Total $10,611 RT % of Annual Total 100%
Annual Report Reference:	#8, Page 244, R-42A	

OBJECTIVES:

1. To determine the outcome effectiveness of the Day Care Pulmonary Rehabilitation Program;
2. to identify the characteristics of the ancient population needing the program;
3. to determine the benefit of the program for each patient;
4. to determine the costs of the program;
5. to determine the limitations of the program.

METHODOLOGY:

1. Interviews were conducted with prospective patients entering the program in order to confirm the absence of acute cardiopulmonary disease, the diagnosis of chronic obstructive pulmonary disease, optimal general medical care, positive motivation for rehabilitation, and geographic and financial status acceptable for the program.
2. Patients entering the program complete all baselines studied, including vital signs, pulmonary function screening, exercise testing, and chest ausculation. All these were performed until stable, each day during the program, and at followup.
3. Patients completing the program were evaluated at one, three, six, and twelve month intervals following completion.
4. Data collection instruments include a staff observation form, a patient information form, and a program monitoring.
5. Individual patient changes in key variables will determine the achievement of program outcome objectives. Demographic and cost variables will be documented and will characterize the input and effort in this program.
6. In order to compare the outcome of this program with other programs, the literature will be searched to determine reasonable test alternatives and similar independent and dependent variables.

   The preliminary success of the pilot program has prompted its continuation and expansion into a full service program in the new Rehabilitation Institute in Chicago.

FINDINGS TO DATE: The major results of the program for 40 patients followed two years after the program may be summarized as follows:

Immediately after the program there was a 15 percent increase in pulmonary function (as measured by FEV_1), 74 percent decrease in symptoms of shortness of breath with activities of daily living, a 230 percent increase in exercise endurance and 42 percent increase in the number of patients who had resumed sexual activity. All of these changes were highly statistically significant. **Improvement in pulmonary function (FEV_1) has not previously been reported.**

At two years follow-up, while there was a decrease in pulmonary function (FEV_1) it was still 15-20 percent greater than that projected for a similar group of untreated patients with chronic obstructive pulmonary disease. The symptoms of shortness of breath with activity remained at a lower frequency, exercise endurance and sexual activity at a higher level and **27 percent of those unemployed, on sick leave or in part-time work returned to work full-time or part-time.** Pulmonary disease-related medical costs and number of days hospitalization decreased.

APPLICABILITY: The evaluation outcome has been used by RIC administration to determine if the program should continue or be changed. As a new approach to an old problem this project may be of interest to many service institutions and staff in pulmonary rehabilitation nationally and internationally. The current evaluation outcome will be used to demonstrate the program's effectiveness to referring physicians and other rehabilitation physicians and administrators.

The Rehabilitation Institute of Chicago has made the decision to include the Day Care Pulmonary Rehabilitation Program in the service program and it is currently operative. Such a program change has been based significantly on this evaluation outcome.

382 Electromyographic and Cystometrographic Study of Human Bladder

Principal Investigator:	P. Kaplan, M.D.	
FY 1976		
Status:	Continuing	
Dates:	March, 1975-March, 1977	
Cost:	Annual $6,892 RT Annual $6,892	Projected Total $12,428 RT % of Annual Total 100%
Annual Report Reference:	#8, Page 159, R-37	
FY 1977		
Status:	**Continuing**	
Dates:	**March, 1975-March, 1977**	
Cost:	**Annual $5,695** **RT Annual $5,695**	**Projected Total $12,428** **RT % of Annual Total 100%**
Annual Report Reference:	**#9, Page 110, R-37**	

OBJECTIVES: To determine whether electromyography of the human urinary bladder provides useful diagnostic and function monitoring information in the spinal cord injured patient.

The specific objectives are to determine if there is a quantitative relationship between bladder pressure, volume and electrical activity and whether this relationship is unique (diagnostic) in neurogenic and spastic bladders following spinal cord injury; to evaluate the effect of atropine and urecholine on the bladder EMG.

METHODOLOGY: We have recorded and measured the electrical activity of the human detrusor muscle during filling and emptying and have noted the rhythmicity of the potentials. We observed the mean potential duration of the waves as well as the amplitude. At the same time, we measured the changes in bladder pressure using cystometric methods. What we have intended to show is a correlation of abnormalities in cystometric measurements and abnormalities in the electrophysiological activity of the detrusor muscle.

Forty-five spinal cord injured patients with upper and lower motor involvement of the bladder and five control patients have been studied. In addition, some patients were followed with serial measurements. These procedures started within a short time after the spinal cord injury and were repeated as clinically indicated.

FINDINGS TO DATE: **Data analysis of the project to date** reveals the following:

Bladder electromyography has revealed distinct patterns for the various abnormal sub-groups which are separate and distinct from the control data. For patients with lower motor neuron bladders and absent bulbocavernosis (BC) or anal-cutaneous (AC) reflex little bladder EMG activity could be found. For patients with a positive bulbocavernosis reflex (BC+) but with cystometric evaluation compatible with a lower motor neuron bladder, decreased bladder electrical activity was noted. However, the activity was more than the first group. For patients with a positive bulbocavernosis reflex and a cystometric evaluation showing a pattern of upper motor neuron type bladder, increased bladder electric activity was noted. In patients with paralyzed bladders, whether they were upper or lower motor neuron bladders, a decrease in the electrical potential duration was noted.

In addition to these static characteristics the dynamic cystometric evaluation showed that as the pressure and volume increased the frequency and amplitude of the electric potentials increased and the duration decreased in hypertonic bladders. However, in hypotonic and lower motor neuron bladders the reduction in electrical activity was such that significant statistical correlations were not noted.

The electric potentials were unchanged with changes of position of the electrode; likewise, when one or two electrodes were implanted.

Atropine reduced but did not abolish electric potentials in upper motor neuron bladders. Urecholine increased electric potentials in lower motor neuron bladders whether those bladders were BC+ or BC−. The electric potentials are probably produced by the smooth muscle cells of the bladder wall. They can thus be used to represent the reaction of smooth muscle to pharmacologic agents. The partial response to atropine may be due to stimulatory effects on the smooth muscle of the bladder by the sympathetic nervous system.

APPLICABILITY: Urinary bladder problems of infection, stone formation, obstruction and hyperflexia are common and costly deterrants in rehabilitation of the spinal cord injured person. Many of these can be prevented or reduced by careful assessment of bladder function and correct management.

Jobs of spinal cord injured are interrupted all too frequently by the urinary tract problems indicated above and death occurs in at least 20% of these patients because of urinary tract infection and renal failure.

Finally, the effect of atropine and urecholine on bladder function needs careful study. These drugs or related compounds are used routinely to treat bladder dysfunction. Yet the effects of these agents on the electrical potentials of the neurogenic urinary bladder has not in the past been done.

383 Conceptual Model of Planning and Evaluation of Rehabilitation Services (Former Title: Conceptual Model of Planning and Management of Rehabilitation Services)

Principal Investigator: S. Harasymiw, Ph.D.
FY 1976
Status: Continuing
Dates: August, 1975-July, 1978
Cost: Annual $29,105 Projected Total $92,865
RT Annual $15,420 RT % of Annual Total 53%
Annual Report Reference: #8, Page 181, R-39

FY 1977
Status: **Continuing**
Dates: **August, 1975-July, 1978**
Cost: **Annual $24,958** **Projected Total $76,816**
RT Annual $24,958 **RT % of Annual Total 100%**
Annual Report Reference: **#9, Page 132, R-39**

OBJECTIVES:

1. To develop and refine a theoretical model that incorporates the parameters of time scale, life function scale, agents involved in the process of rehabilitation, disability conditions.
2. Develop a set of standardized scales and/or indicators measuring relevant life functions (e.g. mobility, self care, work adjustment) to measure changes that occur during the process of rehabilitation.
3. Develop a computer based simulation system that would incorporate the various components of the model to test and evaluate its practicality.
4. Based on the conceptual model and its simulation system by computer a model for planning, management and evaluation of rehabilitative services would be built and machine generated cost and life function indicators would be developed to serve as aids in the planning, delivery and evaluation of rehabilitation services.
5. Develop and maintain a computer accessible standardized data base on four disability groups that will provide the "real world" base for the model as well as serve various empirical investigations.
6. Based on normative information, modes of rehabilitation derived from the model would be presented. Data base analysis and evaluation of the rehabilitative process from a cost benefit and cost effectiveness modes would be made and alternative modes of rehabilitation would be presented.

METHODOLOGY: The individual project components follow.

1. Structuring of the theory
2. Modification of life function scales.
3. Empirical data collection.
4. Data Normalization.
5. Development of prototype simulation model (trajectory and parameters).
6. Development of four disability comparisons model (trajectory and disabilities).
7. Development of a rehabilitation agency and activities simulation model (trajectory X disability X agents-agencies).
8. Development of an integrated systems approach.

FINDINGS TO DATE:

A. Time Effort Summary

The Time Effort Summary Chart for this project was presented in 1974 report and consists of nine component operations units plus a dissemination component. To date, the component unit — I **theory development,** component unit — II **life scale development** and the component unit, dissemination, have become active.

B. Initial Model Conceptualization

The first attempt at model conceptualization has already been made by the author.

C. **Theory Development. Component Current Activity.**

1. **Initial Reconstitution of the Model (Phase I)**

The review of the literature was conducted to examine related conceptualizations of the rehabilitation process model and related models used in areas where retrospective functions are considered. Reconstitution of the theoretical model is currently under way based in part on the review of rehabilitation related literature and developments in systems theory, management science, simulation and control theory. Initial variable specifications are currently being made for future machine simulation.

2. **Life Scale Modification and Development Component Activity**

Currently, three data bases are being used and the utilization of a fourth is planned.

3. Exploration is also being made of the spinal cord injury data base for development of indicators of vocational rehabilitation potential.
4. Preparations are currently being made in conjunction with the REHABIS project to explore scaling development with a population of stroke patients.

Revision was made of the theoretical model and the new conceptualization was submitted to **Rehabilitation Psychology** for publication. Another conceptualization dealing with the use of the model in evaluation was submitted for publication in **Journal of Rehabilitation.**

Exploration was made of life function measures used in rehabilitation. On the basis of these measures an item pool was constructed and alternative methods of scaling are currently being pursued. Correlational and factor analysis of 600 rehabilitation patients indicates a high relationship between various ADL items and an overall life function scale, and it indicates the feasibility of developing short reliable, and valid measures of function. The scaling approach by means of Guttman analysis indicates feasibility of such scaling methods.

Based on the Barthel Index and demographic and cost data derived from the CSNS/CMRC data, a cost-function index, BUC (Barthel Unit Cost) was developed and used to test a model of composite indicators for admission and discharge monitoring. A paper describing the BUC indicator development and use was accepted for publication in the **Scandinavian Journal of Rehabilitation Medicine.** Another indicator, LID (Life per Dollar) was developed as a potential indicator for evaluating Comprehensive Medical Rehabilitation Centers' productivity. A paper describing the use of LID in evaluation was accepted for publication in the **American Journal of Public Health.**

Restructuring of the initial variables to be monitored for life trajectories was made. These are currently composed of 183 unit variables. To date, coding of over 600 RIC patients has been made. Of these, 180 are categorized as spinal cord injured (both paraplegic and quadriplegic), 220 are hemiplegic, 52 are identified as amputation and 163 are of varied disability categories.

Data analysis of 615 RIC in-patients was made. This sample includes about 95 percent of the 1975 RIC in-patient population. Statistical analysis showing a discrete breakdown by disability categories was set up showing the relative rehabilitation cost differential of paraplegic, quadriplegic, right and left hemiplegic, amputation, and other disability groups.

The prototype simulation model underwent further computer simulation testing on the IBM 370 computer at Boston University using the computer simularion language DYNAMO.

APPLICABILITY: The model would provide management tools for both patient-client and agency management.

The model would serve as a teaching tool for vocational rehabilitation counselors specifying more precisely the goals of vocational rehabilitation as well as facilitating the communication between counselors, clients, rehabilitation manager and other professionals engaged in rehabilitation services. The development of scales of rehabilitation potential would be one of the goals in the process of developing the LIFE scale subsets.

By means of this model a set of recovery rates with alternate rehabilitative environments, different disability groups and different agents operating on the disabilities could be simulated and compared with practice in the "real world" environment for more effective problem solving.

In patient-client management environment, (e.g. physical therapy, rehabilitation counseling), knowing the types of differential probabilities of success for given individuals, disabilities, and rehabilitation methods would facilitate the selection of alternatives providing the most successful outcomes.

384 Rehabilitation Information System (REHABIS)

FY 1976 Status:	Proposed	
Principal Investigator:	**S. Harasymiw, Ph.D.**	
FY 1977		
Status:	**Continuing**	
Dates:	**August, 1975-March, 1977**	
Cost:	**Annual $47,793** **RT Annual $12,068**	**Projected Total $64,888** **RT % of Annual Total 30%**
Annual Report Reference:	**#9, Page 141, R-44**	

OBJECTIVES: The objective of this project is to develop an information system that will facilitate research and evaluation, patient and administrative management and education in a comprehensive medical rehabilitation center. The information system would have the following characteristics:

a. **Continuous monitoring** of the fundamental informational elements in the medical rehabilitation process.

b. The information should be **appropriate** for and **useable** on a timely basis by relevant personnel.

c. The information system would have to be **cost effective** in the sense that the most relevant information would be processed in the least cost.

METHODOLOGY: The following steps will be followed in developing the rehabilitation information system:

a. Development of data base requirements.
b. Design of data base – implementation of the information system development plan.
c. Design of data collection instruments.
d. Data collection (coding of data).
e. Verification and revision of data base.
f. Pilot detail and summary record print-outs.
g. Pilot statistical analysis and scale development.
h. Full system test – monitoring the information system with regard to ongoing effectiveness, cost and adaptation for future uses and development.
i. Full system implementation.

FINDINGS TO DATE: Implementation of the REHABIS system occurred in the steps described

RIC 1976 patient data from medical and financial records is now continuously being coded directly into data collection sheets which are then keypunched and entered into REHABIS in batch mode.

Computer printouts of selected variables from patient records containing costs by department, therapy activities and patient functional status were produced. The printouts are beginning to take on the appearance of regular monthly reports.

Currently monitoring of the REHABIS components is being made to study its overall effectiveness, cost and adaptation for future system uses, needs and development. Preliminary exploration seems to indicate that system operation and maintenance is much more cost effective than other currently (or previously) used DBM systems at RIC. Based on more precise cost effectiveness analyses a decision may be made to structure the current DHEW-Midwest Regional Spinal Cord Injury Care System (MRSCICS) data base into REHABIS. This would allow both a separate data set maintenance for the purpose of MRSCICS and would provide the normal monitoring and follow-up of the spinal cord injured at RIC from a common data set, thus reducing separate maintenance systems.

Testing of linkage between the RIC accounting information and REHABIS data base is being made. The structural linkage would provide simplified entry of costing data into REHABIS. Also being explored is more automated systems of entry of medical record information into REHABIS (e.g., use of mark sensing).

APPLICABILITY: The product of this research will be an information system which will be heavily utilized by the comprehensive medical rehabilitation center staff for research, education and management purposes. Because of the nature of the information (medical rehabilitation process outcome and cost) many users are anticipated; namely, other medical rehabilitation facilities and practitioners, the insurance industry, the Rehabilitation Services Administration, Congress, and consumer groups representing the target populations as well as the public at large.

For vocational rehabilitation the continual outcome of this project would be utilized for planning and evaluation purposes, particularly vocational follow-up information.

385 Prevention of Urinary Tract Infection in Spinal Cord Injury

FY 1976 Status:	Proposed	
Principal Investigator:	**Y. Wu, M.D.**	
FY 1977		
Status:	**Continuing**	
Dates:	**April, 1976-March, 1978**	
Cost:	**Annual $43,862** **RT Annual $43,862**	**Projected Total $72,374** **RT % of Annual Total 100%**
Annual Report Reference:	**#9, Page 162, R-46**	

OBJECTIVES: This project is divided into two major objectives:

A. **Evaluation of the dynamic mechanism of the bladder against infection.**

B. **Development and evaluation of devices which facilitate bladder infection prevention and/or management.**

METHODOLOGY:

A. Evaluation of dynamic defense mechanism of bladder against infection. Confirm CURDT formula in vivo in spinal cord injured subjects with neurogenic bladder.

1. Measurement of post-catherization residual urine volume.
2. Evaluation of bacterial doubling time in bladder. Determine effect on bacterial doubling time of anti-bacterial agents.

B. Development and evaluation of devices which facilitate bladder infection prevention and/or management.

1. Clinical evaluation of RIC catheter kit.
2. Develop and evaluate home monitoring system for bacteriuria.
3. Develop and evaluate home catheter sterilization procedure.

FINDINGS TO DATE: **Determination of bacterial doubling time in vivo in the spinal cord injured.** Preliminary findings with four patients undergoing multiple bacterial counts of their urine following intermittent catheterization are as follows:

1. Those patients placed on the intermittent catheterization program have a rapid reduction of bacterial concentration. This has caused significant difficulty in determining bacterial doubling time since the bacteria are eliminated after one to two days of complete, frequent emptying of the bladder. While this was not entirely unexpected, the rate of elimination of bacteria is so rapid that doubling times can not be effectively measured. An alternate means of measuring doubling time will be developed.
2. There appears to be a discrepancy in bacterial doubling times when the residual volume is ten cc compared to a higher volume, 20 cc. Hereafter, the larger volume of residual will be used since it leads to more consistent results.

Evaluation of the RIC-Wu Catheter Kit. Initial, clinical evaluation of the RIC-Wu Catheter Kit compared to the conventional (Bard) kit has been completed in ten patients. Additional patients will be evaluated between now and March, 1977.

Preliminary results indicate that the vast majority of the nursing staff find the RIC-Wu Catheter Kit more convenient and quicker to use than the conventional kit. Further, the nursing staff who observed patients during self-catherization feel that patients find the RIC-Wu Kit easier to use.

Most of the patients and nurses noticed the following advantages: less chance of contamination, portable, accessible from the wheelchair, fewer steps and faster, easy teaching and learning, less professional time involved, and less material needed.

Home Catheter Sterilization Procedure. A RIC-Wu multiple use catheter, designed by Dr. Wu in 1975, is undergoing evaluation of sterility following simple sterilization techniques which can be carried out at home. This reusable catheter, if found feasible, can actually be made by patients at home with easily purchased equipment and can be sterilized simply and effectively. The apparent advantage in this reusable catheter is that it will reduce the cost for patients on intermittent self-catheterization to about one-fifth to one-sixth the cost of conventional catheter sets.

APPLICABILITY: The possible procedure changes could be:

a. Shift from use of current expensive and inconvenient catheter set to RIC Catheter Kit.

b. Routine determination of bacterial doubling time and use of bladder emptying frequency chart in bladder management.

c. Broader use (or non-use) of bladder additives to prolong bacterial doubling time.

d. Method of home sterilization of the intermittent catheter.

e. Method of home-determination of urine sterility.

The Illinois Tool works has applied for a patent for the RIC-Wu Catheter Kit and is planning to market it nationally early in 1977.

386 The Natural History of Deep-Vein Thrombosis in the Spinal Cord Injured

Principal Investigator:	**James Yao, M.D., Ph.D.**	
FY 1977		
Status:	**New**	
Dates:	**October, 1976-March, 1977**	
Cost:	**Annual $13,475** **RT Annual $7,500**	**Projected Total $13,475** **RT % of Annual Total 55%**
Annual Report Reference:	**#9, Page 180, R-63**	

OBJECTIVES:

Delineate the natural history of acute deep-vein trombosis in cord injured patients. Particular attention will be paid to: time of onset from time of injury, patient's age, sex, level of injury, completeness of injury, muscle tonus at onset of thrombosis, etiology of injury, associated major injuries and operations, and medical illness that might predispose to thrombosis (e.g., congestive heart failure or history of venous insufficiency).

Compare deep-vein thrombosis incidence using these simultaneous assessment techniques: clinical evaluation, Doppler venous flow studies, impedance plethysmography (IPG), and radioactive ^{125}I fibrinogen scanning and venography (contrast or isotopic), if indicated. Determine the frequency of complications of venous thrombosis such as fatal and non-fatal pulmonary embolism.

METHODOLOGY: Each patient must have spinal cord damage and must have no significant trauma to the lower extremities or pelvis that would make the assessment techniques physically or technically infeasible.

Each patient will be examined upon admission and the pertinent historical and physical findings noted. Each patient will receive a battery of tests within 24 hours after admission: 1) clinical assessment for deep-venous thrombosis, 2) Doppler venous flow studies (Yao and Bergen, 1974), 3) impedance plethysmography (Yao, et al, 1974), and 4) ^{125}I fibrinogen scanning (Todd, et al, 1976). The non-invasive tests (IPG and Doppler) will be provided by the Blood Flow Laboratory (NMH), while the ^{125}I fibrinogen uptake test will be done by the Nuclear Medicine Department (NMH). These rests will be repeated each day of the study, until either the patient develops evidence of deep-venous thrombosis or he has had two negative scanning periods. (If the first scanning period, 7-10 days, shows no evidence of thrombi, the patient will be re-injected and studied for a second period). If after two scanning periods (14-20 days), the patient has not developed venous thrombosis, he will be discontinued from the study. If the Doppler or IPG are positive and the scan is negative, the patient may have a phlebogram for confirmation of the diagnosis (at the discretion of the attending physician). All positive results will be relayed to the attending physician and the decision for treatment will be his.

FINDINGS TO DATE: The principal events in the natural history of deep vein thrombosis in the spinal cord injured to be studied are: time of first onset and selected concommittant events and sequelae. By **daily** screening using multiple (and some very sensitive) indicators of thrombosis formation we will be able to determine when during the first 2-3 weeks they occur and their frequency. The time and frequency of pulmonary embolus (nonfatal or fatal) resulting from deep vein thrombosis will be monitored.

At the same time we will document the demographic and injury-related characteristics of the sample population as well as certain variables which describe how the patient was managed (e.g., frequency and extent of mobility, treatment received and others).

It is not the purpose of this study to find the cause or cure of deep vein thrombosis, but rather to clearly identify when and how often the complication and major sequelae occur.

Project was funded and commenced in December, 1976. It is too early to report significant findings at this time.

APPLICABILITY: Deep vein thrombosis of the legs occurs rather frequently during the first three months following spinal cord injury; more often than had been apparent. When a piece of this thrombosis breaks off, it lodges in the lung, blocking an artery and leading to lung tissue damage and occasionally death. **When deep vein thrombosis occurs during rehabilitation it stops rehabilitation until the threat is well under control, often a period of weeks.** We are attempting to understand when and how this thrombosis occurs so that it can be prevented. There is a very good likelihood that it can be prevented.

387 Vocational Follow-Up of the Physically Restored Unemployed

Principal Investigator: **R. Sakalas, M.S.**
FY 1977
Status: **New**
Dates: **September, 1976-August, 1977**
Cost: **Annual $7,280** **Projected Total $43,368**
RT Annual $7,280 **RT % of Annual Total 100%**
Annual Report Reference: **#9, Page 148, R-45A**

OBJECTIVES: The purpose of this project is to confirm feasibility, demonstrate preliminary outcome and provide operating procedures for increasing vocational placement of the severely disabled **physically restored** who are **unemployed** (PRU), by use of a planned vocational follow-up program. The specific objectives are to:

1. Identify who the PRU are.
2. Select a cohort of PRU with highest probability of vocational placement and describe the criteria for selection.
3. Provide a comprehensive vocational service program to the cohort, directed at paid job placement; describe that program, including cost of service and potential sources of payment.
4. Determine success of the placement effort.
5. Determine the expected impact of a planned vocational follow-up program on PRU served by an average comprehensive medical rehabilitation center.
6. Describe the key procedural steps, time frame and problems to be anticipated in a model PRU vocational follow-up program.

The project will be executed in ten interlocking phased steps consisting of the following units:

1. **Population Identification**
2. **Sample Selection and Telephone Interviewing**
3. **Questionnaire Design**
4. **Questionnaire Completion and Analysis**
5. **Client Selection and Interview** – This phase consists of vocational counseling, identifying client groups most appropriate for the vocational rehabilitation programs. It will be composed of 20 subjects considered most appropriate for vocational counseling, work evaluation and placement. Ten subjects, or one half of the group, will be randomly selected for placement into the vocational evaluation program and the remaining 10 will be maintained as controls for eventual linkage with DVR and program placement similar to the former 10 patients.
6. **Work Evaluation**
7. **Placement**
8. **Monitoring and Scale Revision**
9. **Evaluation**
10. **Dissemination**

FINDINGS TO DATE: This project was begun in November. It is too early to report significant findings at this time.

APPLICABILITY: The procedure being studied and demonstrated in this project is clearly and directly related to maximizing the frequency and speed of vocational placement of the severely physically disabled by integrating the vocational follow-up procedure into the comprehensive medical rehabilitation process.

It is anticipated that the physically restored unemployed meeting follow-up vocational service selection criteria will be eligible for state-federal VR services and will, in fact, be a source of clients for the VR program.

Policy change implications include justification for third party payment of follow-up vocational services as an integral component of comprehensive medical rehabilitation. Of specific importance is the concept of need for early post discharge continuation of vocational services and the support and payment for those services by third parties.

Texas Tech University (RT-21)
Research and Training Center in Mental Retardation

CORE AREAS

Work Potential of the Retarded

An exploration of the capacities for employment of mentally retarded persons including those not traditionally eligible for vocational rehabilitation services.

Counseling the Mentally Retarded and Improving Service Delivery

Central to this core is the role of the counselor in habilitating mentally retarded clients. It has been broadened to include research which evaluates rehabilitation programs toward the end of improving service delivery.

Research on the Special Needs of the Mentally Retarded with Multiple Handicaps

Activities which include special studies of the blind retarded and deaf retarded.

Deinstitutionalization and Community Adjustment of the Retarded

Studies exploring key variables associated with successful community adjustment of the retarded and dealing with social skill training, community attitudes and community based residential facilities.

TEXAS TECH UNIVERSITY

Gerard J. Bensberg, Ph.D., Director
Rehabilitation Research and Training Center
in Mental Retardation
Box 4510
Texas Tech University
Lubbock, Texas 79409

PROJECT TITLES BY FY 1977 STATUS

COMPLETED

Abstract No.

Development of a General Purpose Vocational Assessment Technique (Andrew S. Martin, Ph.D.) 388

Behavioral Architecture: Ecological Designing of Facilities for the Mentally Retarded (James C. Griffin, B.A.) 389

Evaluation of Halfway House Training Programs for the Mentally Retarded (Robert Flexer, Ph.D.) 390

Vibrotactile Learning with Mentally Retarded Subjects (Bill J. Locke, Ph.D.) 391

Identification of Deaf-Blind Individuals and the Development of Education & Rehabilitation Services for Them (Gerard J. Bensberg, Ph.D.) 392

Cooperation and Competition Skills of the Institutionalized Mentally Retarded (Pamela R. Werder, M.A.) 393

Personal-Social Functioning of Cooperative Work-Study Students: Parents' Perspectives (Nancy J. Bell, Ph.D.) 394

Social and Community Living Skill Training of Mentally Retarded Adults: A Comparison of Modeling Procedures (Carol K. Sigelman, Ph.D.) 395

An Evaluation of Three Citizen Advocacy Programs (Gerard J. Bensberg, Ph.D.) 396

CONTINUING

Developing an Empirically Based Training Program in Mental Retardation (Jerry D. Parham, Ph.D.) 397

Group Homes for the Mentally Retarded in the Rehabilitation Process (Carol K. Sigelman, Ph.D.) 398

Delegation of Homemaking Responsibilities to the Mentally Retarded in Three Environments (Jane Coulter, Ed.D.) 399

Factors Underlying Successful Adjustment of the Retarded
Released from Institutions (Nancy J. Bell, Ph.D.) 400

Effects of Special Olympics Participation on Retarded Children,
Families, and Community (Andrew S. Martin, Ph.D.) 401

Extending Rehabilitation Services to the Multiply Handicapped
(Andrew S. Martin, Ph.D. & Robert W. Flexer, Ph.D.) 402

Technology Assessment: Human Rehabilitation Techniques
(Mohammed Ayoub, Ph.D.) 403

Process and Outcome in Cooperative School Programs in Texas
(Carol Sigelman, Ph.D. & Robert W. Flexer, Ph.D.) 404

State Agency Rehabilitation Counselor Functions and the Mentally
Retarded (J. D. Parham, Ph.D.) 405

NEW

A Study of Consumer Needs, Circumstances, and Attitudes
(Gerard J. Bensberg, Ph.D.) 406

DISCONTINUED 1977

Assessing Motivational Dimensions of Vocational Interests in the
Mentally Retarded (Gerard J. Bensberg, Ph.D.)

TRANSFERRED 1976

Effects of Environmental Stressors on Performance of the Mentally
Retarded (Andrew S. Martin, Ph.D.)

PROPOSED

Effects of Competition and Social Stimulation on Job Performance of the Mentally
Retarded (Jerry L. Morris, M.A.)

Effects of Job Enrichment on Work Performance of the Mentally
Retarded (Andrew S. Martin, Ph.D.)

Development of a Hierarchy of Assembly Skill Difficulty
(Project Coordinator, Ph.D., TBA)

Effects of Goal Setting Training on the Job Performance of the
Mentally Retarded (Robert W. Flexer, Ph.D.)

The Relationship Between Principals' Attitudes Toward the
Retarded and Cooperative School Programs and Selected Program Factors
(Thomas Smith, M.Ed.)

Assessing Ethnic Group Utilization of Rehabilitation Services in
Texas (James Clotfelter, Ph.D.)

Vocational Handicapping Conditions as a Function of IQ
(Gerard J. Bensberg, Ph.D.)

Interview Skills of the Retarded: Deficiencies, Consequences, and
Training Approaches (Carol K. Sigelman, Ph.D.)

Issues in Deinstitutionalization (Carol K. Sigelman, Ph.D.)

388 Development of a General Purpose Vocational Assessment Technique

Principal Investigator:	Andrew S. Martin, Ph.D.	
FY 1976		
Status:	Continuing	
Dates:	June, 1972-December, 1976	
Cost:	Annual $11,180 RT Annual $9,890	Projected Total $73,405 RT % of Annual Total 88%
Annual Report Reference:	#5, Page 54, R-8	
FY 1977		
Status:	**Completed**	
Dates:	**June, 1972-December, 1976**	
Cost:	**From beginning to to end of project: $73,405**	
Annual Report Reference:	**#6, Page 12, R-8**	

OBJECTIVES: To construct a test battery for use in vocational evaluation of mentally retarded persons. The basic objectives of this programmatic research effort have been to design an evaluation apparatus that will: (1) provide relatively quick and inexpensive assessment of prerequisite vocational skills and deficits of retarded persons; and (2) serve as a valid assessment technique for a wide range of retarded clients, including the severely retarded.

METHODOLOGY: A survey of the most common jobs available for retarded workers resulted in the selection of a number of skill and knowledge factors which are common to many of these jobs and the construction of appropriate tasks to measure these factors or abilities. The resulting tasks are: eye-hand coordination (linear maze tracing); tool identification (tools or implements used in several broad vocational areas are represented); basic measurement skills (visual estimation and use of a ruler); match to sample; fine motor dexterity (bolt manipulation).

FINDINGS TO DATE: Research on the battery (now called the Prevocational Readiness Inventory) indicates that it is reliable and that performance remains stable over at least an eight-week period of time. Normative data indicate that the P.R.I. is valid for use with severely to mildly retarded persons. Also, data show that scores on the P.R.I. can predict the acquisition of a relatively complex assembly task similar to many tasks found in workshops for mentally retarded persons.

APPLICABILITY: The completed P.R.I. is designed to facilitate prevocational evaluation and training of severely to mildly retarded persons. It will be of use to vocational evaluators and trainers of the retarded in assessing areas of vocational deficit and in prescribing the appropriate prevocational training programs. The P.R.I. will offer vocational evaluators and trainers several advantages over existing evaluation schemes. It is quickly administered (45-60 minutes), very portable, and relatively inexpensive compared to most of the techniques which are available commercially. Also, the P.R.I. will help to fill an obvious void in evaluation services for the severely retarded. Thus, it has clear relevance to the Rehabilitation Act of 1973, which emphasizes increased services to the severely retarded. Finally it will serve as a useful assessment device in future R&T Center research.

389 Behavioral Architecture: Ecological Designing of Facilities for the Mentally Retarded

Principal Investigator:	James C. Griffin, B.A.	
FY 1976		
Status:	Completed	
Dates:	December, 1974-December, 1975	
Cost:	Annual $4,775 RT Annual $2,656	Projected Total $10,295 RT % of Annual Total 55%
Annual Report Reference:	#5, Page 241, R-12	

OBJECTIVES: To empirically determine the effects of population density in working and living environments on retarded persons.

METHODOLOGY: A total of six experiments were conducted to assess territorial behavior, effects of population density on behavioral patterns, attitudes of subjects under different density conditions, and the effects of social density on work behavior of subjects at different levels of mental retardation. The first three experiments explored basic behavioral phenomena and participants' subjective perceptions as number of persons in a plain space (void of physical objects) increased. Eight mildly retarded residents of a state school served as subjects. The experiments were comprised of three phases during which level of population density was varied by using dyads, two groups of four subjects, and one group of all eight subjects. Four trained monitors independently recorded behaviors and the grid or territory occupied by each subject. After each session, subjects were given an attitudinal survey to assess their reactions to population density level.

In experiment 4, pre- and post-test attitudinal surveys were administered to mildly retarded residents regarding their feelings toward their bedrooms with respect to privacy and comfort, before and after a 16-resident room had been partitioned into separate sleeping units. Experiment 5 examined the effects of population density on work performance. Eight mildly retarded, institutionalized subjects performed an inspection and card sorting task under density conditions of 1, 2, 4, and 8-subject groups in a simulated workroom. Experiment 6 was designed as a replication of Experiment 5. Subjects were 48 males, 24 in a low IQ group, and 24 in a high IQ group. Dependent measures were rate of performance, quality or accuracy of performance, and efficiency (a composite measure reflecting both quality and rate).

FINDINGS TO DATE: In Experiment 1, concurrent with increases in population density, there was an increase in territorial behavior. In Experiment 2, it was found that as population density increased, there were significant increments in positive behavior corresponding with decrements in negative behavior and neutral behavior. Experiment 3 found a highly significant correlation between subjects' response to the attitudinal survey and their overt behavior. However, this correlation was negative. That is, more favorable reactions to the situation were associated with less positive overt behavior. In experiment 4, subjects' verbal reactions to change in their bedroom design indicated that individualized sleeping areas produced greater difficulty in housekeeping maintenance and increases in social maladaptive behavior on the part of the residents. Further research is necessary to ascertain whether these subjective reactions correspond with objective behavioral changes.

Data analysis for experiment 5 indicated that increases in population density were associated with (1) highly reliable increases in the rate of work performance, and (2) significant decreases in accuracy. Again, however, subjects' perceptions of the situation were negatively related to their observed work performance.

In experiment 6, higher level retardates were found to generally perform at faster rates than the low level groups. More importantly, all groups performed faster in the 8-person density condition than in the medium (2-person) or low (1-person) conditions. Thus, the presence of several other workers had a positive effect on rate of performance. A quite different picture emerged with respect to quality of performance. Low IQ subjects showed substantial improvement in their work performance under the high density condition; by contrast, high IQ subjects manifested decrements in work quality in this condition.

Analysis of work efficiency scores revealed that the high IQ groups were significantly more efficient than the low IQ groups under the high density condition, but differences between groups were more variable in the low and medium density conditions. The efficiency score heavily weighted rate of work performance, indicating that high IQ subjects were working fast enough that their lower accuracy in the high density condition did not offset their efficiency as sorters.

APPLICABILITY: Increased knowledge about the effects of population density on human behavior can facilitate the improvement of the rehabilitation process of the retarded if appropriately designed physical environments are utilized. Living and working environments may be designed on the basis of research data, in such a way as to be conducive to increasing or fostering "positive behaviors." Empirically derived architectural designs are already proving to be of considerable importance in designing "normalized" group living facilities and sheltered workshops which maximize and maintain performance. Results of this series of studies suggest that the effects of working or living in large groups are not always negative, and raise questions about the validity of standards for facility design.

390 Evaluation of Halfway House Training Programs for the Mentally Retarded

Principal Investigator:	Robert Flexer, Ph.D.	
FY 1976		
Status:	Continuing	
Dates:	September, 1973-September, 1976	
Cost:	Annual $18,750 RT Annual $14,650	Projected Total $75,000 RT % of Annual Total 78%
Annual Report Reference:	#5, Page 121, R-20	
FY 1977		
Status:	**Completed**	
Dates:	**September, 1973-November, 1976**	
Cost:	**Cost from beginning to end of project: $75,000**	
Annual Report Reference:	**#6, Page 178, R-20**	

OBJECTIVES: This training was directed toward the development and evaluation of programs for training the retarded in community living skills. Cottage residents at the Lubbock State School were administered a battery of assessments covering both vocational and other living skills in order to identify specific deficits. While the tests uncovered numerous deficits in work adjustment, the evaluation also disclosed extensive weaknesses in clients' abilities to manage money. Consequently the project shifted in focus to the development and testing of materials and procedures to teach money skills to the mentally retarded.

METHODOLOGY: Both standardized and Center-developed instruments were used to identify areas of skill deficit. As individual and group profiles on adaptive and worker behavior revealed not only deficits in community living skills but in vocational habits as well, the Center developed the **Worker Behavior Checklist** to further investigate this problem. This instrument found a considerable percentage of the clients to have difficulties in the competitive work setting. Since these clients were in competitive employment settings, this area was studied in depth in an effort to identify factors contributing to job loss and job adjustment problems.

The initial deficit identification phase also found clients to be particularly deficient in money management skills. Moreover, a review of the literature on skill training found no comprehensive or systematic program for teaching this basic skill to mentally retarded persons. In light of these considerations the project shifted its emphasis to the development and implementation of such a program for use by paraprofessionals with mentally retarded clients.

The design of the money counting program involved, firstly, defining behavioral objectives and methods to be used in teaching each. Subsequent testing of these techniques led to the development of more detailed instruction and evaluative procedures and materials. Testing and development was done in the Goal Areas of Coin Identification and Value, Counting Coins of the Same Value, Combining Coins of Different Values, and Counting Change. All procedures contained specific instructional methods, error correcting techniques, and evaluation methods. After the training procedures were designed and tested, R&T Center personnel trained groups of paraprofessional in the use of the program. The training of assigned clients was done over a period of time for a variety of objectives depending on clients' strengths and weaknesses.

FINDINGS TO DATE: As an extension of the investigation concerning deficits in vocational adjustment, job placement personnel and supervisors of work study students completed the **Worker Behavior Checklist.** As a general finding the work study students were reported to have considerable deficits in work behavior. Moreover, students who spent more time in competitive employment had no better overall vocational adjustment than students with less time in competitive work settings. While percents of students reported deficient on items by supervisors and counselors were comparable, agreement on which students were deficient was low. In light of the irregularity of these findings, it is possible that variables external to the students, such as counselor-supervisors, communication or characteristics of the supervisor, play a crucial role in the vocational adjustment of the students.

The development and testing of materials and methods to teach the mentally retarded to count money resulted in a **Money Skills Program for the Mentally Retarded,** which included an overview of teaching these skills, evaluation procedures to determine student entry skills and progress, a hierarchy of objectives, teaching techniques and record keeping procedures, instructional aids, and guidelines and materials to train the paraprofessional to teach this skill.

Over a two-period, 160 volunteers from Texas Tech University were trained to use the program. These volunteers provided instruction to approximately 80 clients of the Lubbock State School. Substantial improvements in skills were shown by most of the clients who participated in the program. While obstacles, such as low level of entry skills, learning and motivational problems, and IQ level somewhat reduced the effectiveness of the program, many students who had practically no entry skills achieved complete independence in money skills after program participation.

APPLICABILITY: The unique quality of this project was that most of the objectives were directed at program improvement of the Rehabilitation Project at the Lubbock State School. The program evaluation and development efforts resulted in changes in the program which will improve the quality of rehabilitation for future clients. Development and refinement of training content and techniques aimed at individual rehabilitation plans increased systematic formulation of goals for particular clients and strategies to accomplish these goals. The results of this project are relevant for the operation and improvement of any program aimed at community preparation for the mentally retarded, i.e., development of program curriculum techniques and materials for community skill training.

391 Vibrotactile Learning with Mentally Retarded Subjects

Principal Investigator: Bill J. Locke, Ph.D.
FY 1976
Status: Completed
Dates: June, 1973-August, 1975
Cost: Annual $62,559 Projected Total $62,559
RT Annual $12,954 RT % of Annual Total 20.7%
Annual Report Reference: #5, Page 222, R-22

OBJECTIVES: The primary objective was to examine means by which an instrumentation system involving programmable tactile stimulation could be incorporated into sheltered workshop training of low functioning retarded clients characterized by deficits in sight and/or hearing. Secondary concern was directed toward the assessment of benefits from tactile stimulation to supplement ordinary feedback among retarded individuals with intact sensory systems.

METHODOLOGY: All project activities used a prototype vibrotactile stimulus display unit developed for field-testing by the Southwest Research Institute of San Antonio, Texas. The unit consisted of individual vibrators mounted in a metal chassis out of which protruded metal shafts which were extended to tap the skin. The frequency of taps could range from a series of discrete taps to continuous vibration. The force of the extensions could be roughly controlled by providing different voltage levels. With sensitive adjustments necessary to assure proper skin surface contact with the vibratory unit, the chassis was coupled to a television camera tripod.

The display system was automatically programmed via relay-based electromechanical control components consisting of relays, steppers, timers, pulseformers, a universal receiver, and human test console interconnection panels. Spatiotemporal programming of successive individual vibrators could be totally automated or actuated as a function of ongoing subject performance.

Sixty-two sensory handicapped residents of a state training facility for the mentally retarded served as subjects in a series of procedural investigations and workshop training utilizing assembly and fabrication tasks. The specific tasks used in the study were fuse installation and resistor sorting.

FINDINGS TO DATE: The preliminary investigations indicated that the surface of the back as the locus for not more than eight spatiotemporal vibratory stimulus vectors delivered in a predominantly vertical plane was the most promising approach. Hearing disabled residents were compared on an electronic component installation task as a function of visual versus visual and vibrotactile feedback. The addition of vibrotactile augmentation produced significant but moderate facilitation of workshop performance on this task. Visually handicapped residents were trained and tested in a commercially contracted task of classification and sorting of electronic resistors. Performance depended solely on vibrotactile feedback. Eighty-eight percent of these subjects performed under such support to levels potentially consistent with commercial demands. With enhanced instrumentation, the promise of vibrotactile stimulation to augment or substitute for deficient sensory channels seems well supported and can be effectively applied in vocational training and sheltered work settings.

APPLICABILITY: The project is part of the quest for new prosthetic and training techniques for the severely and multiply handicapped. This project represented an innovative attempt to address the needs of the multi-handicapped mentally retarded by collecting basic evaluative data regarding vibrotactile stimulation as a training aid. An account of benefits for multiply handicapped learners and clients, technical difficulties in use of the equipment, and recommendations for optimal use of this new technology will enable rehabilitation service providers to make more informed decisions about whether to acquire such equipment, and if how to use it effectively.

392 Identification of Deaf-Blind Individuals and the Development of Education & Rehabilitation Services for Them

Principal Investigator:	Gerard J. Bensberg, Ph.D.	
FY 1976		
Status:	Continuing	
Dates:	November, 1974-June, 1978	
Cost:	Annual $30,950 RT Annual $3,450	Projected Total $69,000 RT % of Annual Total 11%
Annual Report Reference:	#5, Page 176, R-25	
FY 1977		
Status:	**Completed**	
Dates:	**November, 1974-June, 1976**	
Cost:	**Cost from beginning to end of project: $69,000**	
Annual Report Reference:	**#6, Page 332, R-25**	

OBJECTIVES: The objectives of this project were:

1. To establish an effectively functioning network of agencies and professional people who can identify and refer suspected deaf-blind children under age 21 for diagnosis and evaluation.
2. To provide appropriate diagnostic services and parent counseling for those children referred.
3. To demonstrate the need for services to deaf-blind children and encourage public schools to develop programs for the multiply handicapped.
4. To identify existing resources for services to the multiply handicapped and stimulate development of new services.
5. To develop manpower to work with deaf-blind.

METHODOLOGY: A letter describing the project and the type of child to be served was sent to agencies and professional persons in the region served by the project. The letter requested that any person under 21 who was suspected of possessing the multiple handicaps of deafness and blindness be referred to the R&T Center, with emphasis placed on those not currently being served by an educational agency. Visitations were made to the major agencies in order to personally acquaint them with the project and also to determine what types of services were being provided. Continuing efforts were made to establish an effective network of communication among all agencies serving the multiply handicapped to improve case-finding capability and coordination of service delivery. As additional resources were identified, assistance was provided in implementing programs for deaf-blind children in their own locales.

When a referral was received from the community, home visits were made to obtain additional information on the child and his family to determine need for diagnostic procedures and counseling. The Lubbock State School was able to expand the comprehensiveness of its evaluations with the aid of consultants in audiology, ophthalmology, and otology. Evaluation capability was greatly improved with the addition of an impedance bridge and evoked response audiometer. Following evaluation and the development of an educational plan, the R&T Center arranged follow-through with the most appropriate agency in the local community.

A deaf-blind class was established at the Lubbock State School. Graduate students from the Departments of Speech, Psychology, and Special Education served as teaching assistants to gain experience in working with deaf-blind children. Additional training was initiated for teachers and rehabilitation counselors in the form of short-term workshops.

FINDINGS TO DATE: In addition to the establishment of an effective referral network, a team of specialists was identified which could provide a comprehensive evaluation of the multiply handicapped. Resources from the Lubbock State School, Texas Tech, and community agencies were utilized.

Of the 54 individuals referred to the project as suspected deaf-blind, 40 received comprehensive evaluations. Diagnostic and evaluation services were not provided for 14 of those referred for various reasons: some parents were unwilling to cooperate, some of the children had been previously identified as deaf-blind and were being served adequately by other programs, and/or some of the children were referred after funding sources were exhausted. There was a change of status in educational services for 24 of the 40 who were evaluated, and in all cases the change in status meant that the client received more intensive programming than previously. At the time of referral, 13 individuals were not receiving any type of educational services. Program placement for these children was facilitated by evaluation and the development of an educational plan. For those who could not be placed in an educational program, home training was provided by project staff until such time as programs could be developed for them. Although most of the children were receiving services when referred, there were 11 whose evaluations indicated that current services were not adequate in meeting their needs. Additional resources were sought in their local communities and necessary programming changes were made.

As an outcome of the project, the Milam Children's Training Center is now seeking funds to support a classroom teacher to serve those who have been located in the Lubbock community. Interest has also been stimulated at the West Texas Rehabilitation Center in Abilene to develop a deaf-blind unit for the multihandicapped. During the closing months of the project, the R&T Center worked closely with Project Child Find to provide background information on clients served in order to avoid duplication of effort. Cooperation with Child Find was excellent, and no problems are anticipated in coordination and continuation of services to the multiply handicapped in the Panhandle.

APPLICABILITY: When this region began, relatively few deaf-blind children were being served in this region. Although estimates regarding the number of individuals with these multiple handicaps did exist, the exact number was unknown. The case-finding survey conducted in this region demonstrated the need for expansion of services to the multihandicapped. This should encourage school and agency personnel to incorporate these findings into current practices and provide additional resources for services to the multiply handicapped.

393 Cooperation and Competition Skills of the Institutionalized Mentally Retarded

Principal Investigator:	Pamela R. Werder, M.A.	
FY 1976		
Status:	Completed	
Dates:	April, 1975-November, 1975	
Cost:	Annual $1,920 RT Annual $1,710	Projected Total $1,920 RT % of Annual Total 89%
Annual Report Reference:	#5, Page 256, R-27	

OBJECTIVES: The objectives of the study were: (1) to test the hypothesis that subjects lower in mental age would be more cooperative than children of higher mental age, as suggested by research on children of different chronological (and mental) ages; (2) to test the hypothesis that behavior is in part a function of the reward structure of the task, so that more competitive reward structures within the context of a cooperative game increase competitiveness; (3) to determine whether or not findings generalize from task to task; and (4) to compare the performance of retarded subjects with that of nonretarded subjects studied previously.

METHODOLOGY: The subjects were 69 institutionalized mildly and moderately retarded adults divided into high and low mental age groups. The first task presented to the subjects was a game in which four players pull strings attached to a pen. Movement of the pen was recorded on a piece of paper on which four circles were drawn. Three variations of this game were played. In the first, subjects were instructed that rewards could be obtained by moving the pen through all four circles (cooperative reward structure). In the second variation, subjects' names were written in the circles and they were instructed that they would receive a reward each time the pen crossed their own circle (competitive instructions). In the third variation subjects were instructed that the player whose circle was crossed the most times would receive a reward for each circle crossed and a bonus reward (increased competition). In each of the three variations competition is counterproductive such that the strategy that would yield the most rewards is to cooperate to move the pen in an orderly way. The second task was a two-person game in which strings were connected to a two-part wooden marble holder held together by magnets. Subjects were told that they would win a reward if they pulled the marble toward their own end of the board and dropped it in a hole there. However, subjects were not told that if they pulled against each other, the magnets would break apart, dropping the marble and resulting in no reward for either subject. Essentially, the task required that one subject yield to the other on any given trial, but allowed for cooperative agreements to alternate on each trial or share rewards gained at the end of the ten trials.

FINDINGS TO DATE: No significant differences in competitiveness, between low and high mental age groups, were found on either task. Contrary to hypothesis and previous studies of normal IQ children, subjects in the low MA groups tended to be less cooperative. On the first task, contrary to predictions, number of circles crossed increased from the cooperative task to the two games with competitive instructions. Analysis of specific responses suggested that subjects had difficulty mastering the demands of the task, coordinating their movements to cross circles in a specified order. Similarly, observation of task performance on the second task suggested an incomplete understanding of the cause-effect relationship between competitive pulling and the breaking apart of the marble holder.

Despite a trend toward increased cooperation in the higher mental age group, the institution does not appear to foster cooperation over competition. Dominance analysis indicated that some subjects were competitive and managed to manipulate others in such a way as to dominate play and win rewards for themselves, while others submitted to this bullying to their own detriment. Neither dominance or submissiveness is a desirable behavior in the community. The study also suggests that institutionalized retarded adults may need training in cooperation and competition skills. In the first place, they do not appear to show the same escalation in competitive behavior found in older American children, possibly as a function of the values incorporated in the institutional structure. More important still is the evidence that institutionalized adults failed to master the cognitive demands of the tasks and the cause-effect relationships embedded in them. Not only might training in competing without dominating or submitting be warranted, but practice in following instructions and mastering the demands of various interpersonal tasks might be needed.

APPLICABILITY: This project is related to priorities on deinstitutionalization and preparation for community placement. Cooperation and competition are among the many personal-social skills which are potentially important in vocational and community adjustment. This study provides information regarding deficits or deviant patterns with respect to these behaviors, which should be remediated in view of the importance of these behaviors in interpersonal relationships.

394 Personal-Social Functioning of Cooperative Work-Study Students: Parents' Perspectives

Principal Investigator: Nancy J. Bell, Ph.D.
FY 1976
Status: Completed
Dates: June, 1975-January, 1976
Cost: Annual $2,625 Projected Total $2,625
RT Annual $1 437.50 RT % of Annual Total 55%
Annual Report Reference: #5, Page 268, R-28

OBJECTIVES: The objectives of this study were: (1) to identify the strengths and weaknesses in personal-social functioning among incoming students in a cooperative work-study program; (2) to determine relationships between levels of personal-social functioning and aspects of parent philosophy and parenting styles; (3) to explore the predictive value of personal background data with respect to personal-social functioning and parenting variables.

METHODOLOGY: An interview schedule was prepared for administration to parents by vocational adjustment coordinators. Completed interviews for 73 students who were scheduled to enter work-study programs as tenth graders were obtained. In addition, background information was collected from vocational rehabilitation counselors' files. Background variables included: IQ, sex, race, family size, family income, and public assistance. Information obtained via parent interviews included: the students' problems and abilities, extent of participation in community and homemaking activities, rules pertaining to what parents allow the student to do, parents' perceptions of the students' independence or capacity for independence, and parental philosophy regarding the encouragement of independence for the student.

FINDINGS TO DATE: In terms of personal-social functioning, incoming work-study students compared quite favorably to other populations studied, particularly mentally retarded adults furloughed from institutions. Although their parents leaned toward perceiving them as independent and capable of independence, and although parents expressed a philosophy of encouraging independence, parents also believed that their children had problems in personal-social functioning.

Correlations among interview variables indicated that parental philosophy and perception of the child as independent were associated with higher personal-social functioning on the part of the student. However, permissiveness of the parent in setting rules for the child's behavior had no relationship to other factors. Activities, abilities, problems and participation in household activities were highly intercorrelated, suggesting a general personal-social competence which manifested itself in a variety of activities and skills. It was not possible to determine whether competent children produce positive philosophies and perceptions in parents, positive parents produce competent children, or both.

Background factors available for clients were not highly predictive of interview variable scores. In multiple regression analyses, only scores on abilities, participation in household activities, and parent perception were significantly predicted by the six background factors, and the percent of variance accounted for did not rise above 32%. Of all of the background factors, the student's ethnic identity was the factor most closely associated with personal-social functioning and parenting measures. Although there were no ethnic differences with respect to activities outside the home and permissiveness of parental rules, nonAnglo students as compared to Anglo students had fewer personal-social problems, higher abilities, and greater participation in homemaking tasks. Furthermore, their parents expressed a higher estimation of their independence and a more positive parenting philosophy than Anglo parents. This finding may be an artifact of nonAnglo parents' overestimating abilities and taking a more positive attitude in completing the interview than Anglo parents did. However, since nonAnglos were somewhat lower in measured IQ yet appeared to be more competent with respect to personal-social functioning, further study of this relationship is required. Although it was predicted that females would be more competent in many activities within the home, this was not the case. The only significant sex difference indicated that females were more active outside the home than males, a finding which emerged only when IQ was controlled, since males in the sample had higher IQ scores than females.

APPLICABILITY: This study was designed to identify personal-social deficiencies among cooperative work-study program students on the assumption that information obtained from parents would be useful to the school staff in understanding their students' functioning outside the school and in designing personal-social curricula to remediate deficiencies identified. It also represented an exploratory attempt to determine which types of students are most likely to have personal-social deficiencies and could aid vocational adjustment coordinators in specifying which individuals and groups of students are most likely to need special attention.

395 Social and Community Living Skill Training of Mentally Retarded Adults: A Comparison of Modeling Procedures

Principal Investigator:	Carol K. Sigelman, Ph.D.	
FY 1976		
Status:	New	
Dates:	February, 1976-January, 1977	
Cost:	Annual $11,638 RT Annual $10,638	Projected Total $11,638 RT % of Annual Total 92%
Annual Report Reference:	#5, Page 31, R-31	
FY 1977		
Status:	**Completed**	
Dates:	**February, 1976-January, 1977**	
Cost:	**Cost from beginning to end of project: $11,638**	
Annual Report Reference:	**#6, Page 192, R-31**	

OBJECTIVES: The objectives of this study were: (1) to determine the relative effectiveness of step-by-step modeling and entire task modeling procedures in facilitating the acquisition of two social skills; (2) to determine the relative effectiveness of modeling procedures and didactic instructions in facilitating the acquisition of two social skills; and (3) to determine the durability of skills acquired through modeling procedures.

METHODOLOGY: Subjects were 113 residents of a facility for retarded adults who demonstrate evidence of vocational potential. On the basis of a checklist completed by supervisors or care providers at the facility, use of the telephone and initiating a social interaction were selected as the basks to be trained. Pre and post treatment functioning was measured using a Behavioral Rating Form on which each behavioral unit of each task was rated as present or absent in the subjects' performance. Step-By-Step modeling consisted of each unit (or step) in the task being modeled for the subject followed by performance of that step by the subject. Entire Task modeling consisted of the entire task being modeled for the subject, followed by performance of the entire task by the subject. Didactic instruction involved a lecture with visual aides and verbal instructions with no modeling of the task. All modeling and lectures were presented via videotape and each subject participated in three training sessions. Posttest measures were taken at the end of the third training session and follow up measures taken two weeks later. Half of the subjects received training in the use of the telephone and half received training in initiating a social interaction.

FINDINGS TO DATE: At posttest, dramatic changes in all groups were evident, and these improvements endured through the follow up two weeks later. The social interaction task showed somewhat less improvement in absolute terms, though posttest and follow up scores were higher than pretest scores in all groups. Subjects with higher IQs performed significantly better after training than those with lower IQs. Additionally, subjects with higher pretest scores still performed significantly better after training than those with lower pretest scores. On both tasks, the Step-By-Step Modeling procedure was significantly more effective than either Entire Task Modeling or Didactic Instructions. No other significant differences between procedures were found. Though it was apparent that all methods were effective in increasing skills from pretest to posttest and follow up, the Step-By-Step Modeling approach was the most effective method of doing so. There were no indications that high and low IQ subjects or those initially high and low in the target skills were differentially affected by any of the training methods.

APPLICABILITY: Deficiencies in social skills of mentally retarded adults are frequently cited as a contributing factor in failures in vocational and community placement settings. The importance of training in such skills while the individual is within the institution has been stressed by several researchers interested in vocational and community placement outcomes. While precise technologies exist to train retarded individuals in vocational tasks, the same technologies have not been adapted for training social skills. This project was designed to help vocational rehabilitators, institutional staff, and trainers of mentally retarded adults to effectively train social skills by evaluating training techniques.

396 An Evaluation of Three Citizen Advocacy Programs

Principal Investigator:	**Gerard J. Bensberg, Ph.D.**
FY 1977	
Status:	**Completed**
Dates:	**September, 1976-December, 1976**
Cost:	**Estimated cost from beginning to end of project: $5,426**
Annual Report Reference:	**#6, Page 207, R-32**

OBJECTIVES: The purpose of this research was to evaluate citizen advocacy projects in regard to:

1. The extent to which their objectives are congruent with the objectives stated in the literature on citizen advocacy.
2. Their administrative structures and functions.
3. Processes used in recruiting, matching, training, and supporting advocates, as well as the processes involved in finding and selecting proteges.
4. Characteristics of advocates and proteges.
5. The nature of advocacy services as they relate to program objectives and impacts on proteges and others.

METHODOLOGY: Three citizen advocacy projects which are funded by the Texas Department of Public Welfare were selected for evaluation. Evaluation team members visited each site for approximately three days to review office files and interview the project Coordinator, selected advocates, proteges matched with these advocates, representatives of agencies which interact with the project and the Department of Public Welfare contract manager. Five interview schedules were constructed, one for each major group of respondents. In addition, two data sheets were constructed for the purposes of gathering background information from files about proteges and advocates and of assessing the completeness of the files.

FINDINGS TO DATE: Results indicated that, in general, the three citizen advocacy projects studied:

1. have objectives which are tailored to the needs of the individual protege but are consistent with the three major objectives of friendship, teaching and representation which are stated in the literature;
2. have adequate administrative procedures, although they are weak with respect to stating written objectives and documenting activity and progress toward objectives
3. achieve their goals of recruiting and matching participants and provide, if not formal orientation, frequent continuing support of advocates;
4. focus their efforts on mildly and moderately retarded adults leaving institutions or requiring additional support in the community in order to maintain adequate adjustment levels;
5. provide a wide range of supportive services to proteges, not only meeting friendship needs but intervening in crises and enhancing the effectiveness of agencies;
6. are favorably evaluated by participants, contract managers, and agency representatives.

The study also indicated that although projects vary in emphasis and quality, there are several common characteristics and common problems to be solved. One such problem is the development of a stable pool of advocates. While the present study did not assess protege progress due to limited funding, descriptions of activities and impacts suggested that the citizen advocacy model is effective and should be assessed more formally to identify program factors which contribute to positive outcomes.

APPLICABILITY: The mandate in the Developmental Disabilities Bill of Rights and Assistance Act (P.L. 94-103) to develop statewide protection and advocacy systems for the developmentally disabled should stimulate development of citizen advocacy programs, along with other forms of advocacy and protection. The research literature suggests the importance to the mentally retarded adult in the community of having, among other supports, a reliable benefactor to provide friendship and instrumental aid. If developmentally disabled vocational rehabilitation clients are to maintain jobs, they are likely to need continued environmental support, and citizen advocacy would appear to be a promising model for providing such support, particularly if vocational rehabilitators could refer clients to citizen advocacy projects during the course of rehabilitation and use advocates as an extension of themselves to aid in identifying needs, monitoring progress during rehabilitation, and providing support after closure. The present study was aimed at providing further empirical evidence to guide future efforts in this direction.

397 Developing an Empirically Based Training Program in Mental Retardation

Principal Investigator:	Jerry D. Parham, Ph.D.	
FY 1976		
Status:	Continuing	
Dates:	March, 1973	
Cost:	Annual$19,300 RT Annual $16,100	Projected Total $77,200 RT % of Annual Total 83%
Annual Report Reference:	#5, Page 65, R-13	
FY 1977		
Status:	**Continuing**	
Dates:	**March, 1973-September, 1977**	
Cost:	**Annual $24,700** **RT Annual $21,500**	**Projected Total $121,020** **RT % of Annual Total 87%**
Annual Report Reference:	**#6, Page 95, R-13**	

OBJECTIVES:

1. To determine training needs of staff working in the field of rehabilitation of mentally retarded persons.
2. To develop and test programmed instructional materials and curriculum guides to meet these training needs.
3. To train rehabilitation personnel in the use of these materials and training programs and in their incorporation into staff development plans.

METHODOLOGY: Surveys have been taken of approximately 200 agencies serving mentally retarded persons to determine training needs. Development of training materials begins with a review of the literature and available training materials. Materials developed by Center staff are field tested and revised before publication in final form.

FINDINGS TO DATE: Survey data from rehabilitation agencies have been analyzed to determine specific areas of training needs for rehabilitation personnel. A three-part slide/tape presentation with a written supplement, "An Orientation to Mental Retardation for the Vocational Rehabilitation Counselor," was produced in 1975.

An instructor-free training package, "Individual Program Planning with the Developmentally Disabled," was completed in 1976. The package consists of two 1-hour videotapes, individual workbooks for the trainees, and a booklet, "How to Implement and Maintain an Individual Program Planning System," which contains guidelines for administrators on implementing the training as well as the system.

A study of the effectiveness of programmed instruction for training paraproffessionals in helping relationships was completed in 1976, and the results are scheduled for publication in monograph form in 1977.

APPLICABILITY: The training materials developed can be used in staff development programs. While this research project will be completed in 1977, the development of empirically based training materials will continue at RT-21. Self-instructional training packages are planned on program planning and evaluation, treatment strategies, motor development training for paraprofessionals, and on training paraprofessionals as communication aides.

398 Group Homes for the Mentally Retarded in the Rehabilitation Process

Principal Investigator:	Carol K. Sigelman, Ph.D.	
FY 1976		
Status:	Continuing	
Dates:	January, 1973-January, 1977	
Cost:	Annual $17,605 RT Annual $14,605	Projected Total $80,500 RT % of Annual Total 84%
Annual Report Reference:	#5, Page 80, R-14	

FY 1977

Status:	**Continuing**	
Dates:	**January, 1973-June, 1977**	
Cost:	**Annual $12,876** **RT Annual $10,810**	**Projected Total $80,500** **RT % of Annual Total 84%**
Annual Report Reference:	**#6, Page 222, R-14**	

OBJECTIVES: The project is a comprehensive inquiry into the nature and effectiveness of group homes for the mentally retarded as environments for personal and social growth essential to vocational success. The research focuses upon three interlocking organisms: the mentally retarded person, the group home as a social system, and the community. Its objectives are (1) to determine critical differences between the institution and the group home as environments for developing social adjustment skills; (2) to determine the interrelationships between group homes and the communities in which they exist, focusing upon integration of the retarded into community life and responses of the community toward group homes and their residents; (3) to identify critical social adjustment problems encountered in group home placements, with an eye toward developing personal-social adjustment training programs designed to correct problems so identified; (4) to assess the effects of group home placement upon retarded clients with respect to personal, social, and vocational adjustment; and (5) to relate changes in group home residents to variables in the group home and its community. The study is, in general, designed to further knowledge of the support system and training strategies conducive to optimal social and vocational adjustment.

METHODOLOGY: Institutions, halfway houses, and small group homes have been compared through use of a scale of normalization developed and administered to houseparents and residential supervisors, and observational studies were conducted to compare actual activity patterns and supervision styles in small group homes and larger, institutional settings. Interrelationships between group homes and their community settings were assessed through use of a group home survey and an indirect attitude questionnaire designed to measure attitudes in the Lubbock, Texas community. A long-range goal of improving personal-social adjustment training in transitional facilities was approached through a multiple step process to culminate in the development of guidelines and recommendations for adjustment training. Where Facility logbooks and behavior rating forms were the primary data sources. Where agreements with operating facilities could be made, a checklist of Skills and Knowledge Important for Community Adjustment was administered to houseparents at six-month intervals for each resident in the facility, supplemented by observation where possible.

FINDINGS TO DATE: A group home survey was completed by almost 50 facilities to yield basic descriptive information. Further information has been collected on each of the major study areas. There were not significant differences with respect to normalization between facilities for the retarded and facilities for the non-retarded. However, analysis of facilities for the mentally retarded indicated that as the number of residents increases, normalization decreases.

Two observational studies have been conducted. The results of one study indicated that leisure behaviors in two group homes were very similar but differed systematically from leisure behaviors in an institutional cottage. The study also indicated that the group homes were characterized by more balance among activity types, particularly by a reduction in the amount of passive leisure and an increase in the amount of household performance. However, the group homes did not seem to be encouraging the kind of goal-oriented, creative leisure which would help the retarded to adjust to independent living. The single most important finding to emerge from the second study was that residential environments differ from one another in complex ways. The study did not uncover differences in staff-resident interaction patterns which would discriminate reliably between group homes and larger, institutional settings.

A study of community attitudes relevant to community placement of retarded adults conducted in Lubbock, Texas, suggested that Lubbock residents lack well-formulated opinions for or against group homes, but are generally somewhat unfavorable. Demographic variables did not go far in predicting which types of people are most receptive to group homes and legal rights for the retarded.

Staff logbooks have been used as a source of data concerning adjustment problems in four facilities of the halfway house design. Individual problem behavior tends to be consistent over time, and often centered on failures of responsibility. However, individual problem behavior could not be readily predicted on the basis of IQ, adaptive behavior, or sex.

A study of personal-social functioning with implications for adjustment in the community developed a method of assessing the job interview skills of the mentally retarded client. Nonverbal behaviors, verbal behaviors, and measured intelligence predicted the favorability of ratings given to interviewees by personnel interviewers.

Analysis of results of studies to establish the utility of the Skills and Knowledge checklist suggested that checklist performance is highly related to IQ score. The checklist discriminated against clients at different levels in a deinstitutionalization program. However, reliability was judged minimally adequate and further work will be done to refine the scale before data from community residences are analyzed.

APPLICABILITY: Better understanding of the nature and effectiveness of group homes will be immediately useful to vocational rehabilitation agencies currently using or planning to use group homes as a rehabilitative tool. In addition, analysis of social adjustment problems of retarded residents in group homes will expedite analysis of similar problems in other settings. Finally, the study is designed to uncover the types of environmental intervention which produce positive change in personal and social attitudes and behaviors relevant to employability and vocational success.

399 Delegation of Homemaking Responsibilities to the Mentally Retarded in Three Environments

Principal Investigator:	Jane Coulter, Ed.D.	
FY 1976		
Status:	Continuing	
Dates:	March, 1973-September, 1976	
Cost:	Annual $10,900 RT Annual $6,900	Projected Total $12,900 RT % of Annual Total 63%
Annual Report Reference:	#5, Page 104, R-16	
FY 1977		
Status:	**Continuing**	
Dates:	**March, 1973-September, 1977**	
Cost:	**Annual $9,175** **RT Annual $5,175**	**Projected Total $17,000** **RT % of Annual Total 56%**
Annual Report Reference:	**#6, Page 239, R-16**	

OBJECTIVES:

1. To compare three types of environments — the institution, the group home, and the natural home in terms of the extent to which they involve mentally retarded teenagers and young adults in the management and performance of homemaking activities.
2. To uncover reasons underlying any reluctance of caretakers to delegate homemaking responsibilities to mentally retarded individuals.
3. Based upon findings, programs will be developed and tested for use by parents and other caretakers who train the retarded and for use by the retarded themselves.

METHODOLOGY: A questionnaire covering 65 distinct household tasks organized under 7 headings was developed in order to determine the extent to which the retarded participate in homemaking tasks and, at the same time, the extent to which they require supervision while performing such tasks. The instrument was completed by three types of caretakers of retarded teenagers and adults: parent, houseparent, or attendant. Respondents were asked to indicate the frequency of the retarded individual's involvement in each task (never, 25%, 50%, 75%, or 100% of the times the task is completed by anyone in the household). The questionnaire also asked for reasons for lack of participation in tasks, the extent of parental prompting required before the retardate begins each task, and the amount of supervision required as the individual works at the task. Parents of normal school children also completed the questionnaire, providing an external standard by which to compare the retarded subjects' amount and type of homemaking participation.

FINDINGS TO DATE: The following groups of subjects constituted the final, usable sample for the study. (1) Trainable School: N=52 students in a public school for trainable children, with a mean age of 14.77 and mean IQ of 42.33; (2) State School: 163 residents of a public institution for the mentally retarded with a mean age of 18.74 and a mean IQ of 49.15; (3) Workshop: 20 adults, male and female in vocational training at a private community center for the mentally retarded, mean age, 22.05; mean IQ 60.85; (4) Educable School: 19 students in a school for educable children at the same private center for the mentally retarded, mean age, 13.68; mean IQ, 61.37; (5) Community

Residential Facilities for Adults: 33 adults in five community settings including group homes, and halfway houses for mildly and moderately retarded individuals; (6) Normal School Children: 74 students in a small town school system. Mean age, 13.15; IQ, not available, but in the normal ranges.

Statistical analyses revealed that the highest homemaking scores among the mentally retarded were obtained by the Workshop sample, the Educable School Group, and the Community Residential Facility sample. Despite a lower mean IQ and age, the Trainable School group scored somewhat, but not significantly, higher than the State School group. The findings suggest a possible lack of homemaking opportunities in the institutional setting, but both of these more severely retarded groups were significantly less involved in homemaking tasks than were the other groups. Although the normal school children had the highest mean score, they were not significantly more active in homemaking tasks than the higher scoring mentally retarded groups.

A conceptual distinction was made between performance and managerial tasks. All groups were more involved in performance tasks than managerial tasks. However, the normal children had the broadest range of participation and appeared, in many cases, to distinguish themselves from the retarded by their higher involvement in managerial type tasks.

Correlating analysis indicated that older children and adults tended to have higher total homemaking scores, as did those subjects with higher IQs. Furthermore, subjects in all groups who tended to need both more urging to begin a task and supervision while performing the task appeared to participate less in homemaking activities.

In light of recent concern with sexism, an analysis was undertaken to ascertain the extent to which homemaking participation of the retarded is governed by sex-role stereotypes. Independent rates classified the questionnaire items as male-stereotyped, female stereotyped, or not sex-typed strongly in either direction. Analysis revealed that while males and females did not differ significantly in their overall participation in homemaking chores, they did differ in the types of tasks in which they participate, and these differences were consistent with predictions based on sex-role stereotypes. Though homemaking participation was also examined in relation to selected family background variables, multiple regression analyses demonstrated that family characteristics were not predictive of homemaking participation. Further analyses are being conducted.

APPLICABILITY: This study supplies needed information and material to vocational rehabilitation personnel and trainers and educators of the mentally retarded. In particular, it helps in identifying critical areas of homemaking in which the retarded need training and guidance. Data collected in the study also are useful in the development of curriculum guidelines which rehabilitation personnel can make available to the retarded or supply to their parents or other caretakers — materials which can aid them in adjusting to their living environment and thereby increase their chances of success in the community.

400 Factors Underlying Successful Adjustment of the Retarded Released from Institutions

Principal Investigator:	Gerard J. Bensberg, Ph.D.	
FY 1976		
Status:	Continuing	
Dates:	July, 1973-June, 1976	
Cost:	Annual $77,972 RT Annual —	Projected Total $195,000 RT % of Annual Total —
Annual Report Reference:	#5, Page 141, R-21	
Principal Investigator:	**Nancy J. Bell, Ph.D.**	
FY 1977		
Status:	**Continuing**	
Dates:	**July, 1973-July, 1977**	
Cost:	**Annual $13,512** **RT Annual $9,545**	**Projected Total $195,000** **RT % of Annual Total 71%**
Annual Report Reference:	**#6, Page 249, R-21**	

OBJECTIVES:

1. To assess changes in the characteristics of the retarded individuals who are furloughed and discharged from residential facilities during an eight-year period.

2. To study the relationship between individual characteristics of the retarded persons and the critical behaviors they exhibit which result in success or failure in community adjustment.
3. To evaluate the role of various supportive services which are important in maintaining retarded persons in the community.
4. To study the quality of the personal, social, and vocational life of retarded persons who have been furloughed or discharged from state residential facilities.
5. To compare the procedures and operational philosophies regarding furlough and discharge of residents in eleven residential facilities.
6. To assist not only the Texas Department of Mental Health and Mental Retardation, but agencies throughout the country, in developing more effective plans for selecting and training retarded individuals for community placement and for developing community services.

METHODOLOGY: The first stage of this project involved mailing questionnaires to a sample of 500 former residents of Texas state schools for the retarded who were discharged from 1968-1973. Various topics relating to community adjustment were addressed in these questionnaires. Background data on each subject was provided by the institutions. Personal interviews were conducted with a sub-sample of both those who responded and those who did not return the mail questionnaire. Stage One of the study was designed to permit comparison of those discharged in past years with those furloughed from institutions in 1974 in Stage Two. Stage Two of the study involved a longitudinal follow-up of those individuals furloughed for at least 90 days from any of the Texas state schools during 1974. These people were contacted shortly after separation from the institution and then periodically thereafter for approximately 2-1/2 years. Individuals from all age and ability levels were included in the sample. At each community contact, information was obtained from a personal interview with the client, a guardian or houseparent interview, and observations made by the interviewer about the client's behavior and environment. Guardians or houseparents were also asked to complete an adaptive behavior rating form. This rating, along with ratings of work skills, were also provided by state school personnel at the time of a subject's furlough. Upon a client's return to the institution, guardians and state school personnel were asked to provide information about reasons for return and problems encountered in the community. Information was obtained for all subjects in the form of background and psychometric data from institution records. In order to compare community lifestyles and problems of previously institutionalized retarded persons with those of nonretarded community residents, a short form of the client interview was administered to 151 residents of Lubbock, Texas, who were similar to the retarded sample in age, sex, and ethnic characteristics.

FINDINGS TO DATE: **Mail Survey.** Based upon information obtained from approximately 39% of the sample, there were lifestyle differences between ability groups (IQ below 55 and IQ 55 or above) on most variables examined. The lower ability group was living a more sheltered life and appeared to be more dependent upon others than the high ability group. Examining adaptive behavior scores in relation to employment suggested that some minimal level of skills may be important, but beyond this minimum level, increasingly higher scores did not differentiate the unemployed from those employed. Thus, while it might be possible to develop predictive estimates of the likelihood of employment and degree of independent living based upon IQ and adaptive behavior scores, this prediction would not be very precise. The most important difference between high and low ability individuals may involve a variety of community support factors. These environmental factors include kind of training received while in the institution and agency assistance in the community. Those with IQ's above 55 received more training and agency support than did the lower ability group, which may in itself be a primary reason for community lifestyle differences. In comparing leisure activities of retarded persons with the non-retarded, the respondents were divided into three major groups for analysis: moderately retarded (IQ below 55), mildly retarded (IQ 55 and above), and community sample. Types of leisure activities were categorized as community interaction (attendance at movies, restaurants, clubs, etc.) or social activities (contact with friends, dating, etc.). In community interaction activities, the mildly retarded did not differ from the community sample. In the areas of social activities, however, participation of the community sample exceeded that of the mildly retarded group, which in turn exceeded that of the moderately retarded. Differences between the groups in socio-economic and marital status are possible explanations, as are IQ-related differences in social knowledge and skills, differences in opportunities to meet people and possible constraints placed on social life by living at home with parents. Personal evaluation of lifestyle was measured by responses to items asking which things were problems from the respondent's point of view. A greater number of the retarded than of the community group reported problems finding friends (same and opposite sex) and problems figuring out what to do with their time. **Longitudinal Follow-Up.** Data collection was completed in June, 1976. A total of 582 individuals were included in the sample. The final current status on each client was established as of October 31, 1976, three years after the first furlough reports were received. As of that date, 55% had received discharges from the institutions, 32% were still on furlough status, 12% had returned and were residents of the institutions, and 1% were deceased. Major analysis of the longitudinal data currently underway are designed to clarify: (1) what the status and experiences of clients are at different time periods after furlough; (2) what variables change significantly over time; and (3) what variables predict adjustment at various times.

APPLICABILITY: This study will provide general feedback on the current status of clients who have been institution residents and permit comparisons of those discharged in the past with those currently being placed in community settings. The identification of particular areas of difficulty shortly after separation from the institution can provide the basis for expanding or altering emphasis in existing pre-release training programs. Similarly, difficulties occurring later after separation may suggest the need for certain types of community support programs. There are potential long-range implications of this information for selecting and placing residents. This study, perhaps in combination with the results of other recent studies of the same type, may permit fairly good prediction of which individuals will do well in community placement at a given point in time and thus are ready for separation, as opposed to those who would benefit from additional training. Also, it may aid in identifying important determinants of the type of placement most suitable for a given individual. It is hoped that the findings will aid both institutions and community agencies in deinstitutionalization efforts and in providing appropriate supportive services.

401 Effects of Special Olympics Participation on Retarded Children, Families, and Community

Principal Investigator:	Nancy J. Bell, Ph.D.	
FY 1976		
Status:	Continuing	
Dates:	November, 1974-October, 1977	
Cost:	Annual $89,167 RT Annual $2,544	Projected Total $173,010 RT % of Annual Total 2.8%
Annual Report Reference:	#5, Page 156, R-24	
Principal Investigator:	**Andrew S. Martin, Ph.D.**	
FY 1977		
Status:	**Continuing**	
Dates:	**November, 1974-October, 1977**	
Cost:	**Annual $91,474** **RT Annual $2,544**	**Projected Total $173,010** **RT % of Annual Total 2.8%**
Annual Report Reference:	**#6, Page 263, R-24**	

OBJECTIVES: To conduct an experimental study of the impact of the Special Olympic Programs to determine what changes are occurring to the mentally retarded participants that can confidently be attributed to the program itself, and are not attributable to the multitude of other events occurring daily at home, at school, in the community, and even at the State-Federal level.

METHODOLOGY: The study has two major foci: (1) Impact of Special Olympics participation upon the mentally retarded children, their parents and teachers, and the effects on the community, and (2) The administration of the National Special Olympics Program.

I. The impact of Special Olympics participation is being studied through a repeated measures design with four communities which had no previous Special Olympics involvement. In two communities (experimental communities), experimenters established Special Olympics Programs, and two communities remained as controls. Repeated measures in each community over the three-year longitudinal study include: physical, achievement, and personality measures of the students themselves; teacher evaluations of students; progress data from existing school records; parental reports of home behavior of the student, degree of parental participation and attitudes toward programs for the retarded; professional services provided for the retarded; monitoring of community newspapers, city council meetings, and activities of community groups; and several unobtrusive measures of community attitudes.

II. Questionnaires were sent to the 50 state directors and included questions in the following areas:

1. What elements make up, and are necessary for a successful Special Olympic Program;

2. Evaluations and recommendations in terms of the present training program for mentally retarded students as outlined in the Special Olympics Program;
3. Evaluations and recommendations of present activities included in the current Special Olympic Program.

Each of the 50 state directors were asked to supply the names of 8-10 communities in their state they feel have a successful Special Olympics Program and 8-10 communities they feel do not have a successful Special Olympics Program.

On the basis of these findings, an experimental program was conducted with a State School during the second year of the project. Emphasis was placed on developing and testing training methods which would enable those individuals now excluded from programs to participate.

FINDINGS TO DATE: The project is currently in its final year, and final data analysis will be completed June-August, 1978. Since the data is longitudinal in nature, meaningful comparisons between participants (experimental groups) and nonparticipants (control groups) cannot be made until final post program-initiation data are collected. Previous years' activities included the development and testing of specialized instruments as well as adaptation of some existing instruments to meet the requirements of the study. Among those instruments developed for use in this project are:

(1) A self-ranking inventory for mentally retarded children.
(2) A pictorial social distance scale for mentally retarded children.
(3) School attitude scale.
(4) Activity information scale.
(5) Activity preference scale.
(6) A modified Harvard Step Test for measuring Cardio-Respiratory Fitness in young mentally retarded children.

Data collection has proceeded twice yearly since 1974, and preliminary results indicate positive effects on participants' physical fitness and cardio respiratory functioning as a result of participation in organized Special Olympics Activities and training.

APPLICABILITY: One of the primary objectives of this investigation is to isolate factors which contribute to successful Special Olympics Programs so that all existing and future programs may benefit in terms of participant training and program administration. Since the foundation responsible for the initiation and continued support of the Special Olympics Program has funded this investigation, it is clear that there is an interest in program development which can readily lead to changes or recommended changes in practice if indicated by this research. It is hoped that recommendations stemming from this study will not be limited to Special Olympics Program changes, however, but will lead to a more global improvement in physical education programming for retarded individuals.

402 Extending Rehabilitation Services to the Multiply Handicapped

Principal Investigator:	Andrew S. Martin, Ph.D.	
FY 1976		
Status:	Continuing	
Dates:	July, 1974-July, 1977	
Cost:	Annual $65,342 RT Annual –	Projected Total $174,118 RT % of Annual Total –
Annual Report Reference:	#5, Page 185, R-26	

Principal Investigators:	**Andrew S. Martin, Ph.D. and Robert W. Flexer, Ph.D.**	
FY 1977		
Status:	**Continuing**	
Dates:	**July, 1974-July, 1977**	
Cost:	**Annual $65,342** **RT Annual 0**	**Projected Total $174,118** **RT % of Annual Total 0**
Annual Report Reference:	**#6, Page 24, R-26**	

OBJECTIVES:

1. Develop procedures to utilize task analysis and learning principles to evaluate the needs of

severely retarded clients for entry into sheltered workshops.

2. Design and implement individual training programs for vocational behavior prerequisites, work task performance, and work-related behaviors.
3. Train workshop personnel in methods of task analysis, evaluating training needs, and designing training programs.

METHODOLOGY: Initial efforts centered on conducting evaluations of strengths and weaknesses of sheltered workshop/work activities center dropouts, that is, lower level students who had failed for various reasons to adjust successfully to a workshop regimen. Task analyses were performed on subcontracted jobs which were already being performed by workers in the sheltered workshop. The task analysis and pursuant evaluation/training of clients provided data concerning task acquisition and problems encountered in the areas of motor, discrimination, and sequencing skills required of the subcontracted jobs. Task analyses of jobs were redone and learning principles were further analyzed for applicability when training data indicated a lack of effectiveness for given training strategies. Thus, a refining process was developed, whereby strategies were constantly evaluated in light of their effectiveness.

Task analysis and application of learning principles were also utilized to identify and ameliorate behavioral deficits in the work adjustment area. In training productive, adjusted workers, modifications of the physical training environment and feedback systems were designed to eliminate maladaptive behaviors and build responses necessary for work adjustment which were not in the behavioral repertoire of clients. Training programs, drawing on successive approximation and cue fading, for example, provided environmental features which were used to reduce various off-task and disruptive behaviors.

FINDINGS TO DATE: One series of studies was conducted to determine behavioral prerequisites for performing workshop jobs, the training required for severely retarded clients to acquire work skills, and effective strategies for training difficult operations in workshop jobs. In one study two procedures were compared for training time, production rate, and transfer savings. Results show that training time, errors, and production were near equal for a hand method vs. a foot-hand method for inserting staples in packages. The demonstration goal was met in this study in showing that severely retarded workers can be trained to do more than the simplest hand assembly work and that training time is no longer for the more complex method requiring eye-hand-foot coordination than for simpler methods. In another study, analysis of training data revealed that different error rates occurred for steps in assembling an eight-piece ball point pen, that errors were very high in early sessions, and then plateaued at about 15% for several sessions, with a sudden drop to criterion on acquisition. In addition, on post-criterion trials, few errors occurred, indicating that a criterion of ten consecutive errorless assemblies was adequate.

A second group of studies addressed problems of work adjustment of the severely retarded. Redesigned work stations, an off-task signaling system, small incremental time increases, and a monetary reward system were used in a training program to develop the work tolerance of severely retarded clients who had been released from a sheltered workshop because of extremely short "attention span," disruptive behavior, and low production. Results show that in as little as 27 days of training, one hour per day, mean time-on-task increased from 60% during baseline to 97%. Similar techniques were successful in training self-initiation of cycles in a repetitive task, as seen in increases in number of self-initiated cycles.

Factors underlying a work ethic with the severely retarded were also investigated in this project. Clients performed a work task for pay, charted earnings daily, and were taken on a weekly field trip to spend their earnings or saved toward future purchases. Under the field trip condition, production increased 41% over baseline, and saving for goals resulted in a 65% increase compared to production rates in a baseline condition. Studies are continuing in order to develop additional strategies for training work skills and work adjustment in the severely retarded.

APPLICABILITY: While recent legislation has mandated that the full range of rehabilitation services be extended to severely handicapped persons, including severely and profoundly retarded persons, this mandate is meaningless unless the technology exists and is available to practitioners who make these services possible. Until recently, the technology simply has not existed to make services available to the severely mentally retarded because practitioners were not able to teach or train these clients using the same techniques which are at best partially successful with higher level clients.

The goals of this project are to bring together results of other research, augmented by studies of our own, in order to develop and define a set of strategies for evaluating training needs of the severely retarded and an organized technology of training retarded persons. Only with a technology developed with and for retarded persons can rehabilitation practitioners begin to offer the type of services which can habilitate this group of clients.

403 Technology Assessment: Human Rehabilitation Techniques

Principal Investigator:	Mohammed Ayoub, Ph.D.	
FY 1976		
Status:	New	
Dates:	May, 1975-December, 1977	
Cost:	Annual $262,400 RT Annual $1,800	Projected Total $262,400 RT % of Annual Total 1%
Annual Report Reference:	#5, Page 9, R-29	
FY 1977		
Status:	**Continuing**	
Dates:	**May, 1975-June, 1977**	
Cost:	**Annual $262,400** **RT Annual $1,800**	**Projected Total $262,400** **RT % of Annual Total 1%**
Annual Report Reference:	**#6, Page 104, R-29**	

OBJECTIVES: The overall objective is to systematically assess the potential consequences of alternative programs and emphases in rehabilitation so that the problem of disability itself is clarified and so that the implications of various efforts on behalf of the disabled are considered in advance of program implementation.

More specifically, the objectives of the technology assessment project are:

1. To specify variables in society which are related to rehabilitation and which may affect or be affected by changes in rehabilitation;
2. To analyze the problem of disability in the United States, based on existing information about prevalence, etiology, needs or impairments, costs to the nation, and so on;
3. To describe the state of the art in rehabilitation, indicating what current and emerging technologies constitute potential solutions to the problems of the disabled;
4. To systematically assess the short-term and long-term consequences of selected rehabilitation program thrusts or alternatives;
5. To provide decision-makers, policy-formulators, rehabilitators, and the general public with recommendations and objective analyses of the policy implications of alternative rehabilitation programs.

METHODOLOGY: A conceptual model developed for the study describes the needs of the disabled in terms of the following five life functions: mobility; health; communication; cognitive-intellectual functioning; social-attitudinal functioning. The assumptions are that disabled persons fall short of normal functioning in one or more of the life functions, and that assessment of functional impairments is the most fruitful way in which to characterize the needs of the disabled for rehabilitation.

The conceptual model also specifies four types of rehabilitation technologies or approaches to the problem of disability: physical intervention; training/counseling; environmental change; change in service delivery.

With the conceptual model as a framework for analysis, the study is being conducted through a combination of literature review, survey, consultation with experts, and committee work.

Based on such considerations as prevalence and severity of handicap, the following disabilities were selected for intensive case study; (1) rheumatoid arthritis, (2) coronary heart diseases, (3) emphysema, (4) cancer of the colon/rectum, (5) kidney diseases, (6) diabetes mellitus, (7) schizophrenia, (8) mental retardation, (9) epilepsy, (10) paralysis or loss of motor control associated with cerebral palsy, stroke, or traumatic spinal cord injury, (11) visual impairment or blindness, and (12) hearing impairment or deafness. Fourteen case studies will be undertaken, including separate studies for the three causes of paralysis. Each case study disability is described in terms of: (1) definition(s), (2) prevalence and incidence, (3) demographic distribution, (4) etiology, (5) impairments with respect to life functions, (6) implications for functioning as a member of the labor force and member of the community, (7) current technologies applied to the group, and (8) current service delivery organizations and functions.

Rehabilitation technologies are being analyzed in order to identify major technological alternatives and to describe their costs and benefits. Analytical papers have been prepared on broad topics such as housing, transportation, education, and income supplementation.

Resulting information on the societal context of rehabilitation, the problems of disability, and the state of the art in rehabilitation will be prepared for use by working committees which will assess the consequences of alternative programs. A limited number of major groupings of technologies or coherent programs will be chosen for assessment. The working committees will be composed of social scientists, specialists in rehabilitation fields, and disabled persons representing respectively the voices of analysts of society, rehabilitators, and consumers of rehabilitation. Using a structured technology assessment procedure, four working committees — one for each of the four types of rehabilitation technology — will consider the consequences for disabled as well as nondisabled persons of implementing alternative programs on a large scale.

FINDINGS TO DATE: During the fall of 1975, work began on the 14 disability case study papers. Results of the preparation of these papers reveal that the definitions of disability are unstandardized, unoperationalized, and generally unindicative of functional needs. Partly because of the diversity of definitions, estimates of the prevalence of various disabilities vary widely.

The analysis of technologies applied to the rehabilitation of the disabled revealed that there is a real need for some sort of centralized information exchange concerned with rehabilitation technologies. Technological development goes on in many cases in isolation from the mainstream of rehabilitation activities, and little or no technology literature bears on the development of technology based on needs assessments.

The reports on the case study disabilities have been completed, and the data from these reports has been analyzed and summarized in the report, **Scope of the Problem of Disability: Life Functions.** This report offers conceptual schemes for analyzing the scope of the problem of disability and provides data and analysis on definitions of disability, prevalence rates, demographics, etiology, life function needs, and status in the labor force and community.

A second report, **Rehabilitation Technologies,** consisted of data on technologies employed in the rehabilitation of the 14 case study disabilities. The rehabilitation technology inventory collected was only a sample of the technologies currently available. There were a number of problems involved with the data collection, such as limitations of time and personnel, fragmentation in the literature, and lack of effective communication of agencies and individuals about rehabilitation technology.

APPLICABILITY: The findings of the technology assessment of human rehabilitation will do much to: (1) integrate information about various disability groups served by RSA, (2) identify need commonalities and priorities, and (3) serve as a guide in the formulation of rehabilitation policy. The conceptual model for the project offers a means of examining, regardless of disability label, functional needs which can be met with rehabilitation techniques. The analysis of impacts on society of various rehabilitation efforts should provide a useful base of information for policy makers by identifying iterrelationships between rehabilitation and other societal systems.

404 Process and Outcome in Cooperative School Programs in Texas

Principal Investigator:	Carol Sigelman, Ph.D.	
FY 1976		
Status:	New	
Dates:	January, 1976-June, 1977	
Cost:	Annual $14,950 RT Annual $13,225	Projected Total $20,000 RT % of Annual Total 89%
Annual Report Reference:	#5, Page 16, R-30	
Principal Investigators:	**Carol Sigelman, Ph.D. and Robert W. Flexer, Ph.D.**	
FY 1977		
Status:	**Continuing**	
Dates:	**January, 1976-June, 1977**	
Cost:	**Annual $17,772** **RT Annual $14,720**	**Projected Total $26,658** **RT % of Annual Tota 83%**
Annual Report Reference:	**#6, Page 115, R-30**	

OBJECTIVES: The objectives of this study are: (1) to describe process variables in cooperative school programs (CSPs) in Texas, identifying components of programs which vary from school to school and from client to client; (2) to measure outcomes of cooperative school programs in terms of the client's level of social and vocational information, vocational status at the end of the twelfth grade, and rated adjustment in a vocational placement; and (3) to identify relationships between process and outcome variables which would indicate that certain program offerings and experiences contribute to client success.

METHODOLOGY: This study represents an attempt to determine which program factors contribute to the effectiveness of cooperative school programs. Its basic design included the following:

1. **Sample Selection:** A list of graduating seniors and a list of their primary disability was obtained from each cooperative school program. To limit the number of programs from which students were sampled and to represent proportionately program variables of possible importance, it was decided to classify the graduate lists on the basis of four relevant variables. Proportionate numbers from each classification were selected to equally represent the distribution of variables in the population of graduates.
2. **Background Variables:** Data collected consisted primarily of that which was readily available in the VAC's student/client files or on the rehabilitation agency's central computer file (e.g. ethnic group, secondary handicaps, available standardized achievement test score, number of years in special education placement, number of family members.
3. **Process Variables:** The key personnel in the cooperative school program — the Vocational Adjustment Coordinator, Director of Special Education (DIR), the Vocational Rehabilitation Counselor (VRC), and the Rehabilitation Supervisor (SUP) — were asked to complete a questionnaire about program characteristics, operation, and offerings. The VAC and VRC also completed another questionnaire pertaining to each individual student in the study. Questionnaires completed for each subject in the study were designed to reveal individual differences in experiences within the context of a general program.
4. **Outcome Variables:** Outcome measures, collected just prior to graduation, consisted of the following: (1) the **Social and Prevocational Information Battery,** (2) Information obtained from vocational rehabilitation case files and from VACs and VRCs concerning income, type and length of job placements, and judgments about current work adjustment and prognosis. (3) **The Worker Rating Form,** developed by the Texas R&T Center, and completed by student's employer or work supervisor.

FINDINGS TO DATE: Analysis of open-ended questions concerning the greatest strength in CSPs revealed that a substantial portion of the respondents (30%) felt that smooth and open communication among CSP personnel, regular school staff, administrators and the community was the greatest strength of their CSPs. The next most mentioned strength was VAC competence. Regarding weaknesses, communication again was the most frequently mentioned area, but it was perceived only about half as many times as a program deficit than as a strength. Fifteen percent of the respondents perceived a shortage of on-campus training opportunities as the greatest weakness.

The VAC, VRC, and DIR responded to a rating form asking them to determine whether the performance of various staff roles, including those in special education and rehabilitation, was below, at, or above expectations. While the VRCs rated nearly half of the VACs as performing above expectations, vocational education and regular teacher roles were frequently perceived as below expectations. VAC and DIR ratings of the staff roles were similar to those of the VRC in terms of percentages of roles perceived as being performed below, at, and above expectations.

In order to identify factors which facilitate or inhibit the effectiveness of the CSP, all responding groups completed a Likert-type scale consisting of items related to program success. Each respondent rated each factor as it related to their CSP on a scale ranging from excellent to very poor. While the overall means for each item were high for all rating groups, two factors — curriculum availability and availability of jobs — emerged as relatively weak factors.

Correlations performed to assess the extent to which different participants in the same programs agreed in their perceptions of the factors in program effectiveness found a moderately high degree of agreement among CSP personnel.

Analysis of the individual items, however, indicated that intra-agency agreement was generally higher than interagency agreement. In comparing subgroups on favorability of item ratings, the SUP and DIR, persons who are more remote from the CSP, were generally more favorable in their ratings than were the VAC and VRC. Analysis is continuing.

APPLICABILITY: The idea for the proposed study originated with the Texas Rehabilitation Commission (TRC). Specifically, the program specialists in mental retardation voiced a desire for a study which would not only provide systematic information about the effectiveness of the cooperative school program, but also identify components of such programs which contribute to successful outcome. Because the Texas Rehabilitation Commission, the Texas Education Agency, and the R&T Center are full partners in conducting the study, its relevance and potentials for utilization are maximized. Because it appears that no studies focusing on relationships between process and outcome in cooperative school programs have been done elsewhere in the country, the present study will have potential relevance to program planning and design outside of Texas. Finally, this first attempt at a process-outcome analysis should have heuristic value, stimulating further studies aimed at improving the benefits derived from cooperative school programs for the mentally retarded.

405 State Agency Rehabilitation Counselor Functions and the Mentally Retarded

FY 1976 Status:	Proposed	
Principal Investigator:	**J. D. Parham, Ph.D.**	
FY 1977		
Status:	**Continuing**	
Dates:	**September, 1976-February, 1978**	
Cost:	**Annual $16,600** **RT Annual $15,800**	**Projected Total $24,300** **RT % of Annual Total 95%**
Annual Report Reference:	**#6, Page 133, R-33**	

OBJECTIVES:

1. To gather basic data on the functions typically performed by state agency rehabilitation counselors working with mentally retarded persons, specifying what tasks are performed and the proportion of time devoted to different tasks and task categories.
2. To make comparisons between general caseload counselors and counselors working primarily with the retarded with regard to the types of data specified above.
3. To make comparisons among mental retardation specialist counselors from the different state agencies in Region VI with regard to the types of data specified above.
4. To prepare an annotated bibliography of literature pertaining to the functions of counselors working with mentally retarded persons.

METHODOLOGY: Wright and Fraser's (1975) "Rehabilitation Task Performance Evaluation Scale" was selected for use in this study and was revised and expanded. This inventory will provide detailed information regarding which tasks rehabilitation counselors perform, the amount of time they devote to different tasks and task categories, and their perceived training needs for performing different tasks. Cooperation is being solicited from the directors of the seven state rehabilitation agencies in Region VI, with the aim of obtaining two samples of counselors (one of general caseload counselors and one of mental retardation specialist counselors) from each agency. When the samples are established, copies of the inventory will be sent to the selected counselors. State agency directors are being requested to set aside three hours of uninterrupted time during May, 1977 for counselors to complete the inventory. Counselors will return the inventory by mail to the Research and Training Center, at which time the data will be analyzed and interpreted.

FINDINGS TO DATE: This study is currently in progress and has not yet produced any findings.

APPLICABILITY: The findings of this project have potential use for all individuals who work with retarded persons. They should be particularly helpful to state agency counselors in evaluating and improving their performance with mentally retarded clients and to state rehabilitation administrators in selecting, preparing, and utilizing rehabilitation personnel for work with retarded persons. The findings of this study can also be incorporated into undergraduate and graduate rehabilitation programs and into continuing education and in-service training.

406 A Study of Consumer Needs, Circumstances, and Attitudes

Principal Investigator:	**Gerard J. Bensberg, Ph.D.**	
FY 1977		
Status:	**New**	
Dates:	**January, 1977-December, 1978**	
Cost:	**Annual $52,496** **RT Annual $42,550**	**Projected Total $100,000** **RT % of Annual Total 81%**
Annual Report Reference:	**#6, Page 279, R-34**	

OBJECTIVES: The President's Committee on Mental Retardation commissioned this study with the main objective of determining whether a national consumer sampling approach is a feasible way of quickly determining the needs and attitudes of the retarded in such a way that national policy could be formulated based on the information received. The feasibility of such an approach will be determined by: (a) developing procedures which address problems of identifying and accessing a representative sample of retarded persons; (b) determining the most valid and reliable interviewing techniques to be used with a retarded population; (c) developing written guides and training procedures for interviewers; and (d) testing the adequacy of sampling and interviewing techniques used as a data base for policy-making. This study will also seek to meet PCMR's second objective of providing information on the needs, circumstances and attitudes of a sample of retarded persons with respect to: (a) the extent to which community services are available, known to, utilized, and positively received by the retarded consumer; (b) the nature and quality of his/her living circumstances; and (c) the extent to which he/she has the opportunity for decision-making in regard to his/her life circumstances.

METHODOLOGY: Review of previous prevalence estimation studies will be the primary methodology for constituting an ideal sample based on a matrix broken down by various demographic variables. In order to determine the feasibility of actually locating, gaining clearance for, and obtaining consent from subjects, major agencies will be polled by mail on their policies regarding release of information about clients. Also, during the interviewing of the retarded subjects, extensive records will be compiled on problems encountered and time spent with various techniques of accessing subjects. Content areas have been limited to: (a) availability, accessibility, need for, use of, knowledge of, and attitudes toward services for the retarded; (b) nature and quality of residence, income, and social life: and (c) opportunity for and experience in decision-making. Instruments to be developed include a background information form, and agency survey, a client interview form, a parent or "significant other" form, and an interviewer observation form. After clearance of these forms by the Washington offices of RSA, OHD, and OMB, a series of pilot studies will be completed to explore determinants of responsiveness, reliability and validity, as well as to guide the selection of questions for the final interview study. This series of pilot studies will result in a final questionnaire which optimizes responsiveness and reliability, as well as research reports which clarify several critical issues in the feasibility of interviewing mentally retarded persons.

FINDINGS TO DATE: Since the study is still in formative stages, there are presently no findings. However, progress has been made in several areas. In November, 1976, project staff members met with PCMR staff and representatives. The meeting covered both substantive and procedural issues involved in the feasibility test. Findings were presented from an epidemiological study on the distribution of identified mentally retarded persons by age, disability level, and pattern of residence. Decisions were made to limit the content to living circumstances, services, and decision-making, to include children in the sample, and to treat different responses of clients and their "significant others" as differences in perspectives which would represent "facts" of policy significance to PCMR. With these decisions in mind, the project staff has studied and identified several kinds of consideration in question construction. A tentative client interview has been formulated and revised several times. Concomitantly, literature reviews on communication of the mentally retarded, child language development, response sets in interviews, and prevalence estimation were started. Review of the literature on communication skills of the retarded is almost completed. Various scaling techniques and methods of data analysis are also currently being considered.

APPLICABILITY: The study will provide an assessment of the needs of the severely retarded and the multiply handicapped, as well as information about how well agencies are meeting their needs and those of the entire range of mentally retarded persons. This is especially relevant due to the current emphasis on serving the severely handicapped and providing programs for them at the community level. In order to fulfill the spirit of consumerism in current legislation for the handicapped and to provide a mechanism for feedback, some assessment of the attitudes of the handicapped toward rehabilitation agencies needs to be made. This project will be designed so as to obtain information which should be readily used by service agencies in better understanding their clients and enabling them to better meet the clients' needs. Data will be collected which can be utilized by federal agencies in evaluating their present programs and in formulating national and agency policy.

University of Wisconsin-Stout (RT-22)
Vocational Rehabilitation Research and Training Center

CORE AREA

Vocational Evaluation

The development and dissemination of new knowledge in vocational evaluation and the client service areas interfacing with vocational evaluation, (which include work adjustment, vocational training, follow-up, and counselor/client decision making), and also the development of demonstration programs in the areas of client referral to vocational facilities and effective facility service utilization.

UNIVERSITY OF WISCONSIN – STOUT

Daniel McAlees, Ph.D., Director
University of Wisconsin-Stout
Stout Vocational Rehabilitation Institute
Vocational Rehabilitation
Research and Training Center
Menomonie, Wisconsin 54751

PROJECT TITLES BY FY 1977 STATUS

COMPLETED

Abstract No.

Assessing Vocational Aptitudes Using a Task Performance Rating Scale (Norman Scheinkman, Ph.D.) ... 407

Factors Influencing Vocational Rehabilitation Counselor Utilization of Vocational Evaluation Services (Charles C. Coker, Ph.D.) ... 408

CONTINUING

Effects of Vocational Evaluation Programming on the Vocational Development of Rural High School Youth (Frederick E. Menz, Ph.D.) ... 409

Identification of Work Reinforcers Found in Sheltered Workshops and Their Relationship to Client Vocational Needs (Frederick E. Menz, Ph.D.) ... 410

Feedback Systems for Insuring Quality in Facility Based Services (Fredrick E. Menz, Ph.D.) ... 411

Process and Outcomes of Vocational Evaluation Services (Dennis J. Dunn, Ed.D.) ... 412

Differential Treatment of Functional Disabilities in Work Adjustment Programming (Charles C. Coker, Ph.D.) ... 413

The Effects of Vocational Evaluation on Client Vocational Awareness, Attitude and Competency (Fredrick E. Menz, Ph.D.) ... 414

Telecommunications in Training of Rehabilitation Facility Personnel (Charles C. Coker, Ph.D.) ... 415

Development of a Competency-Based Staff Development Program for Vocational Evaluators and Adjustment Specialists (Charles C. Coker, Ph.D.) ... 416

Factors Influencing Counselors Determination of Client Eligibility and Referral for Facility Services (Charles C. Coker, Ph.D.) ... 417

DISCONTINUED 1977

Training in Vocational Rehabilitation (Dennis J. Dunn, Ed.D.)

OTHER

Impact of Training on Career Patterns of Vocational Rehabilitation Personnel (Not Activated)

Development of Vocational Exploration and Orientation Media (Not Activated)

Co-Worker Expectations and Their Effects on Client Placement and Post-Employment Success (Not Activated)

PROPOSED

Accuracy and Consistency of Data Collected on Client Characteristics in Facilities (Fredrick E. Menz, Ph.D.)

Reliability of An Approach to Estimating Functional Capacities of Clients Receiving Vocational Evaluation (Fredrick E. Menz, Ph.D.)

Research and Training Utilization and Interfaces (Research Specialist, Ph.D.)

407 Assessing Vocational Aptitudes Using a Task Performance Rating Scale

Principal Investigator:	Norman Scheinkman, Ph.D.	
FY 1976		
Category:	Completed	
Dates:	September, 1972-April, 1975	
Cost:	Annual $4,072	Projected Total $17,519
	RT Annual $3,192	RT % of Annual Total 78%
Annual Report Reference:	#4, Page 8, R-2	

OBJECTIVES: To determine the reliability and validity of an Abilities Self-Rating Form for utilization by vocational evaluators.

METHODOLOGY: To determine the construct validity of the scale, the General Aptitude Test Battery was used. Test-Retest reliability estimates were undertaken with a minimum of two groups of subjects. An analysis on the relationship between the two scales was done using Chi-Square Analysis and correlation techniques. In conjunction with the above, an experimental design was devised to assess reactive effects of the Aptitude Self Rating Form.

FINDINGS TO DATE: Studies of the test-retest reliability of the Abilities Self Rating Form indicate that these were in the .70 range. A construct validation study based on factor analysis was undertaken to determine the similarity of the factor structures of the Abilities Self Rating Form and the General Aptitude Test Battery. The obtained factor structures had little apparent relationship to each other, or to the factor structure hypothesized on the basis of previous research. These results suggested that abilities are structured differently in the disabled than in the non-disabled.

Overall, the significant findings of this project can be summarized as follows: (1) disabled persons are able to reliably estimate their ability levels; (2) disabled persons show changes in their perceived ability levels as a result of vocational evaluation programming; (3) there are small, but generally significant, relationships between self estimated and measured ability levels; (4) the structure of measured abilities appears to be different in the disabled from that found in the non-disabled; and (5) the structure of perceived abilities in the disabled appears to be different from the structure of their measured abilities.

408 Factors Influencing Vocational Rehabilitation Counselor Utilization of Vocational Evaluation Services

Principal Investigator:	Charles Coker, Ph.D.	
FY 1976		
Status:	Completed	
Dates:	September, 1972-January, 1976	
Cost:	Annual $24,861	Projected Total $44,367
	RT Annual $19,492	RT % of Annual Total 78%
Annual Report Reference:	#4, Page 17, R-3	

OBJECTIVE: To determine client characteristics and conditions related to counselors referring their clients for vocational evaluation services.

METHODOLOGY: A 16 item open-ended pilot questionnaire (The Facility Utilization Questionnaire) was administered to 10 Wisconsin district office rehabilitation counselors. These findings supported the need for a more comprehensive approach to determining influences on rehabilitation counselor facility referrals as well as provided some data for the simulated case design. A package of six simulated cases was developed based on the above data (Currie, 1974), severity of disability (Rehabilitation Act, 1973), and risk group typologies (Lorenz, 1973). Actual cases existing in closed status in three Wisconsin DVR District Offices were consulted for simulated case content. These actual cases were modified and all identifying information was concealed for confidentiality.

The resulting cases were constructed in a format which allowed the respondent to order choices of information (Adapted from McGuire and Babbott, 1967), including medical, non-medical specialists reports, and casenotes. The goal of the simulation was to determine eligibility. However, because a vocational evaluation report was part of the information available for each case, facility usage data could be isolated. A brief client description was included for reference prior to information selection. Each information item was folded and stapled and identified only by title so that participants could not read ahead. Hence the process of selection consisted of (1) reading the client description, (2) selecting which report was desired first from a list of available information (3) reading that selection, (4) selecting additional information if desired, (5) and completing an eligibility statement. The respondent had the opportunity of completing the eligibility statement anytime following reading the client description. There were five casenotes per case which were the only information materials requiring a sequential ordering (that is Casenote 5 could not be selected earlier than Casenote 1; however, casenotes could be scattered throughout the choice of other information — for example — 1. General Medical, 2. Casenote 1, 3. Orthopedic, 4. Casenote 2, 5. Psychiatric, 6. Psychological, 7. Vocational Evaluation, 8. Casenote 3).

FINDINGS TO DATE: The project examined vocational evaluation's role in the decision-making process associated with counselor determination of eligibility for rehabilitation services. It was found that:

1. Vocational evaluation was typically used late in the search for client data which suggests counselors may make their final decision only after examining vocational evaluation. Across all six cases and twenty-six counselors, vocational evaluation was used 58% of the time.
2. Counselors typically use around 5-9 reports to determine eligibility and the decision to accept or reject clients does not appear to vary with the number or type of reports, but with the probability of rehabilitation success (risk).
3. Vocational evaluation, as most general reports, did not vary with client characteristics as indicated by consistent use across the six cases.
4. Counselor characteristics were not studied, per se, but those characteristics of the counselor in the present project did not appear to affect the use of vocational evaluation or the decision concerning eligibility.
5. The simulated case format is viewed both as an effective research and training method, but the optimal research procedure for employing simulated case material is not necessarily optimal for training purposes.

A detailed description of the project is available as a University of Wisconsin-Stout Research and Training Center Monograph: **Rehabilitation Facilities Referrals—Step 1: Determining Client Eligibility.**

409 Effects of Vocational Evaluation Programming on the Vocational Development of Rural High School Youth

Principal Investigator:	Fredrick Menz, Ph.D.	
FY 1976		
Status:	Continuing	
Dates:	September, 1972-December, 1976	
Cost:	Annual $5,550 RT Annual $4,351	Projected Total $30,662 RT % of Annual Total 78%
Annual Report Reference:	#4, Page 35, R-5	
FY 1977		
Status:	**Continuing**	
Dates:	**September, 1972-June, 1977**	
Cost:	**Annual $10,070** **RT Annual $7,183**	**Projected Total $35,670** **RT % of Annual Total 71%**
Annual Report Reference:	**#5, Page 36, R-5**	

OBJECTIVES: The Equal Opportunities Projected funded by ESEA consists of exposing reluctant learners in 20 school systems to a vocational evaluation experience which concentrates on vocational exploration and goal study. A second component of this project involves the project staff in developing school-vocational program recommendations for each student jointly with the student, school personnel, and parents. The third component involves follow-up with school personnel in implementing these recommendations, as need requires. Finally, regular periodic follow-up counseling is provided by the project staff to students after they return to school. The objective in the program evaluation of the Equal Career Opportunity Project (ECO) were a) to identify short and long-term effects of vocational evaluation on vocational development and b) to identify short and long-term effects of vocational evaluation and school follow-up on school-related behaviors and continuing vocational development.

METHODOLOGY: Students participating in the ECO Program during FY 1973 (N=140), 1974 (N=120), and 1975 (N=90) were the samples for this project. These students are referred to as reluctant learners and were identified by the schools as students characterized by having low academic achievement, high potential for drop-out, poor attendance, tardiness, etc. Two types of data were collected respective to the two goals of the ECO project: Student data on the CMI, a norm-referenced measure, and data on students obtained with questionnaires developed and highly specific to the intents of the project. Criterion levels for each objective were pre-established and evaluation of the attainment of the several objectives was conducted against these for the projects vocational development and school goals. Simple t-tests and descriptive statistics were input into a basic judgement scheme to formulate judgements as to whether the project appeared to be attaining each of its goals.

FINDINGS TO DATE:

Attainment of the Vocational Development Goal.

ECO had a definite impact upon the attitudes of students toward entry into the world of work and career choice. It also tended to have positive impact upon the students' 1) ability to appraise vocational and educational capacities; 2) to solve problems related to career choice, and 3) to plan strategies for pursuit of a career. These findings are reported by professionals' judgements and tends to be corroborated with pre- and post-measures obtained from the CMI. By the end of vocational evaluation reluctant learners do not appear to have developed a capacity to utilize occupational information or formulate and select goals as evidenced by the data sources employed in this evaluation. However, there is some evidence to indicate that this capacity does develop by one year after evaluation.

Attainment of the School Goal.

Attainment of objectives and progress toward this goal of establishing more positive behaviors in school is mixed, with generally good effects on specific dimensions. Effort and quantity and quality of school work significantly improved within one year of participation in the program in both the vocational and academic areas (see Ferstenou's study below). Students tended to be better adjusted to school after vocational evaluation, but this adjustment did not appear to be maintained. Their interest in school was not consistently found to be as positive as other students. Their attitudes toward themselves improved subsequent to evaluation and appeared to be maintained after one year. Finally, they tended to develop a better capacity than other students, to formulate vocational goals. They do not appear to lose this capacity after a year back in school.

410 Identification of Work Reinforcers Found in Sheltered Workshops and Their Relationship to Client Vocational Needs

Principal Investigator:	Fredrick Menz, Ph.D.	
FY 1976		
Status:	Continuing	
Dates:	September, 1972-July, 1976	
Cost:	Annual $2,200 RT Annual $1,725	Projected Total $16,457 RT % of Annual Total 78%
Annual Report Reference:	#4, Page 48, R-9	
FY 1977		
Status:	**Continuing**	
Dates:	**September, 1972-June, 1977**	
Cost:	**Annual $5,036** **RT Annual $3,592**	**Projected Total $19,656** **RT % of Annual Total 71%**
Annual Report Reference:	**#5, Page 52, R-9**	

OBJECTIVES:

1. To determine the pattern of work reinforcers characteristic of workshops in general.
2. To determine the pattern of vocational needs characteristic of workshop clients.
3. To determine the relationship between characteristic work reinforcer and client vocational need patterns.
4. To determine the feasibility of providing an extended range of work reinforcers within the workshop setting.

METHODOLOGY: The sampling unit for this project is the sheltered workshop unit. Five sheltered workshops, using the Minnesota Importance Questionnaire, were identified and requested to participate in the project. The variables of interest are the twenty common work reinforcers identified by the Work Adjustment Project, University of Minnesota. The Minnesota Importance Questionnaire and Minnesota Job Description Questionnaire were used to collect the data. Workshops participating in the project already have Minnesota Importance Questionnaire data available on clients. Workshop supervisors and professional persons were asked to complete a Minnesota Job Description Questionnaire indicating the reinforcers available to clients under their supervision. Client and supervisor data are being analyzed on each reinforcer dimension using analysis of variance to determine if there are any between workshop differences. If no differences emerge, data will be pooled to meet objectives (a) and (b). Objective (c) will be met by analysis of profile data using analysis techniques developed for the profile data by Vocational Psychology Research, University of Minnesota and by R & T Center staff in project R-11.

FINDINGS TO DATE: Analysis of data obtained from 35 supervisors on the Minnesota Job Description Questionnaire (MJDQ) and from 177 clients on the Minnesota Importance Questionnaire (MIQ) at five workshops in Region V is now proceeding. Of the twenty needs and reinforcers addressed on these two instruments, 90% of the needs fall in the low moderate to moderate levels of importance, as do 65% of the reinforcers. Few of the needs are of little importance to clients, but reinforcers for 35% of them are not available in workshops. Fifty per cent of the needs and reinforcers are totally congruent, and an additional 20% of the needs and reinforcers are within comparable ranges, yielding a common profile of needs and reinforcers for 85% of the needs and reinforcers measured by the MIQ and MJDQ. Generally flat profiles of needs and of reinforcers across the five workshops appear to be evidenced. Further analyses are being conducted to reveal consistency and inconsistency with which differential reinforcement-need patterns are provided within the context of the several workshop settings.

411 Feedback Systems for Insuring Quality in Facility Based Services

Principal Investigator:	Fredrick Menz, Ph.D.	
FY 1976		
Status:	Continuing	
Dates:	September, 1973-July, 1977	
Cost:	Annual $50,022 RT Annual $39,760	Projected Total $171,355 RT % of Annual Total 79%
Annual Report Reference:	#4, Page 59, R-17	
FY 1977		
Status:	**Continuing**	
Dates:	**September, 1973-June, 1982**	
Cost:	**Annual $38,607** **RT Annual $27,536**	**Projected Total $514,271** **RT % of Annual Total 71%**
Annual Report Reference:	**#5, Page 171, R-17**	

OBJECTIVES: The central objectives of this developmental project on service quality are 1) to generate a comprehensive feedback system for determining intra-and inter-facility program quality and renewal; 2) to conduct research studies geared toward assessing the effectiveness of the feedback system, and 3) to conduct integrating research on methodologies for measuring the effects of facility services.

METHODOLOGY: A programmatic research strategy is being employed toward application and testing of the prototype feedback system and toward resolving methodological issues in measuring rehabilitation service effects. The significant questions guiding research on the quality of the feedback system are questions dealing with (1) the integrity of the system; (2) the utility of the system within the facility (intra-program utility); and (3) the utility of the system within facilities (inter-program). Based upon an analysis of the prototype system and specific issues related to these questions, research studies are designed to efficiently evaluate individual components and/or related components. Two types of studies are developed: pilots and projects. Input and direction for conducting pilot studies come largely from (1) priorities established through issue analyses, (2) problems identified in use of the system; and (3) measurement issues which present themselves. They are directed at (1) finding tentative answers to measurements and assessment problems and (2) to finding immediate answers to operational nuances. They are exploratory studies employing informal as well as formal design techniques. Formal projects are those studies which require higher use of Center resources and cover a broader base of issues, respective to the system, its methods, and its content. They are formally reviewed and documented, prior to initiation, and are based upon both issue analyses and the pilot studies. Collectively, these studies constitute the major validation and/or summative evaluation of the system.

FINDINGS TO DATE: Two principal accomplishments have been made under this project: (1) formalization of a prototype feedback system which, by being integrated in the service delivery of facility programs, is the focal point in a quality-assurance cycle and (2) drafting of the first of two implementation guides for use with the system. Both are the foci of the programmatic research under this project. As such, distribution of the detailed structure of each, of necessity, is controlled and release of the final model and guides will be dictated based upon the findings of the research and evaluation and redevelopment which is to occur throughout the project.

Prototype Feedback System. The first step in using the system is to fully delineate the structure, contents, inputs, and intents of the program. Implementation of the system is accomplished through a highly systematic analysis of a sample of past clients: (1) their characteristics; (2) an inventory of service patterns and other inputs (such as human and fiscal resources); and (3) an inventory of specific treatment intents of the services. This analysis results in an initial basic data system, defined on individual clients. This core data system dictates data subsequently entered into the system on current and future clients. Once the data system is established, programming objectives are defined (with respect to client characteristics, program inputs, treatment intent, and expected outcomes) and an initial outcome evaluation conducted. From these, processive and efficiency evaluation is introduced to empirically determine needed alterations to the program. Next, redevelopment takes place and initiation of a continuous feedback renewal cycle is accomplished. The general structure of the feedback system requires a continuous scrutiny of the program's quality, by monitoring or evaluating its effectiveness and efficiency, with an eye toward possible redevelopment.

Draft Implementation Guide. The two guides are intended to be the vehicles by which nonprofessional program evaluators (practitioners) in facility services implement and use the feedback system. They are to contain a functional evaluation and feedback system for practitioners in facility services, which does not require external evaluator/researcher consultation. In other words, it is the goal in these guides to provide facility-service-based practitioners with everything they need to analyze their program and clients, determine realistic objectives, define the data elements for their data system, and install and utilize the evaluative procedures of the system. Each guide coincides with a different phase in evaluation and planning: The first establishes the data system and procedures for evaluation of program effectiveness and the second deals with monitoring, efficiency (including effort), process evaluation and program renewal. Each guide has two main parts: The Test and the Supplements. The Test contains the meat, background, procedures and instructions for conducting each step. The supplements, in turn, provide specific technical information, supports, materials, forms and specific guides that are needed, and may not be conveniently available to those using each guide. All necessary materials and instruments are provided in these self-contained documents for full use of the system.

412 Process and Outcomes of Vocational Evaluation Services

Principal Investigator:	Dennis Dunn, Ed.D.	
FY 1976		
Status:	New	
Dates:	April, 1974-September, 1977	
Cost:	Annual $28,966	Projected Total $87,000
	RT Annual $22,711	RT % of Annual Total 78%
Annual Report Reference:	#4, Page 80, R-20	
FY 1977		
Status:	**Continuing**	
Dates:	**April, 1974-May, 1977**	
Cost:	**Annual $50,357**	**Projected Total $79,323**
	RT Annual $35,916	**RT % of Annual Total 71%**
Annual Report Reference:	**#5, Page 60, R-20**	

OBJECTIVE: To measure the impact of vocational evaluation services upon client change. (Vocational evaluation client's characteristics, vocational evaluation personnel characteristics, and significant vocational evaluation techniques will be identified. The interrelationships of these variables will be studied to determine their effects on client change).

METHODOLOGY:

1. Identification of characteristics of vocational evaluation clients.
2. Identification of characteristics of vocational evaluators.
3. Identification of Vocational Evaluation Techniques.

PROGRESS AND FINDINGS: The identification of client characteristics has been attained. Survey data suggests that clients referred for vocational evaluation services could be categorized into three groups depending upon their characteristics and service needs. The first group is comprised primarily of younger (less than age 24) single clients who are mentally retarded or have developmental disabilities and little or no work experience. This group has functional problems related to vocational development and maturity and would be most likely to benefit from a vocational evaluation program which stresses the development of personal and social awareness related to vocational success. The second group of referrals are those who are older, married, and possess a reasonably good vocational history and skills, and typically have an acquired disability. This group would probably best benefit from a placement oriented vocational evaluation program. The third group is made up of clients who are older, have less than high school education, have had either no work experience or four or more jobs, have multiple handicapping conditions and display extreme behavior patterns or difficulty conforming to rules. This group would best be benefitted by an orientation and adjustment program prior to evaluation.

Research on techniques for objectively observing client work behaviors suggested that: (1) client behavior can be objectively and consistently described in observable form; (2) behavioral norms can be established within rehabilitation facilities; (3) individual behavior profiles based on standard scores are easily interpretable; and (4) there are significant differences in observed client behavior patterns between facilities and between programs within facilities.

Additional studies undertaken on the point sampling behavior observation method indicated that interobserver agreement was in the .90's, while observer accuracy was typically at the 92% level or beyond. A comparison of the accuracy of point sampling with other observation strategies indicated that it, overall, was the method with the highest accuracy, reaching the 99% level with 80 or more observations. However, it was also found that observational accuracy is a function of the specific behavior being observed, the observational method used, and the number of observations made. In a related study, the test-retest reliability of a behavioral rating scale as a function of the length of time an individual was in a program was examined. These results suggested that it was only after an individual has been in a program for 12 days or more that ratings were sufficiently reliable (.70 or beyond) to be of value in individual programming.

Other findings of significance during this reporting period include: (1) Mentally retarded client performance on simulated work tasks can be improved by some 10-18% by the simple expedient of setting a goal; (2) individual learning equations developed from initial task acquisition data can predict subsequent performance with an average error of less than 1%; (3) the use of industrial standards and norms with scores obtained from initial performance attempts on work tasks tends to underestimate the actual functional abilities of the individual; and (4) time score distributions obtained from simulated work tasks have a significant skew which cannot be eliminated through common score transformations, suggesting that the treatment of these data by the application of psychometric techniques is questionable.

413 Differential Treatment of Functional Disabilities in Work Adjustment Programming

Principal Investigator:	Charles Coker, Ph.D.	
FY 1976		
Status:	New	
Dates:	January, 1975-December, 1978	
Cost:	Annual $5,911 RT Annual $4,634	Projected Total $96,000 RT % of Annual Total 78%
Annual Report Reference:	#4, Page 96, R-21	
FY 1977		
Status:	**Continuing**	
Dates:	**September, 1975-June, 1977**	
Cost:	**Annual $33,571** **RT Annual $23,945**	**Projected Total $39,482** **RT % of Annual Total 71%**
Annual Report Reference:	**#5, Page 88, R-21**	

OBJECTIVES: If "work adjustment" is viewed as a program rubric for adjusting persons to work rather than a "treatment" in and of itself, it is recognized that this program could be implemented from several theoretical perspectives. There are two major obstacles facilities face in offering differential treatment modalities within work adjustment. They are:

1. insufficient or limited treatment skills repertoire by facility staff, and;
2. an inability to establish a clear programmatic model of work adjustment by facility staff. The research objectives are:
   a. to survey facilities to ascertain the types of treatment(s) offered in work adjustment along with descriptions of types of client problems confronted;
   b. to develop specific treatment modules with respect to facility needs and to determine their overall effectiveness.

METHODOLOGY: The project involves three different activities requiring different methodologies. These are:

a. Develop and validate specific work adjustment treatment modules. The procedure to be followed for this activity is essentially an iterative developmental approach with the following steps:
   (1) Select client problem area: Significant work adjustment client problem areas will be selected on the basis of existing RTC data, data to be collected from short-term RTC trainees, and other information resources.
   (2) Develop treatment module: During this phase, each problem will be stated in behavioral terms along with a goal or desired behavior. The literature will then be searched to locate one or more specific treatment techniques which have been shown to be effective in dealing with the problem. Each treatment technique will be written up in a step by step format. Additionally a method for determining the effectiveness of the treatment technique will be developed.
   (3) Field test treatment module: Each treatment module will be field tested in one or more work adjustment programs.

b. Develop functional classification system.

c. Develop work adjustment treatment package. The third and final phase of the project involves the development of a comprehensive treatment manual for work adjustment problems organized around the functional classification system. This manual will be based upon the empirical evidence gathered during the developmental phase. It will be field tested in a manner similar to that used to develop the initial treatment modules, i.e., by being installed in selected facilities or programs and data gathered to determine the effectiveness of the manual.

FINDINGS TO DATE: Based on preliminary surveys of problems in the field of work adjustments and further model building, there exists a decisive lack of concrete definition of work adjustment and use of specific treatments for specific disabilities. The project's intent to solve these problems was noteworthy, but the all inclusive nature of the problems could not be handled with the R & T Center budget and staff restriction. This project, therefore, will be discontinued in favor of more detailed projects dealing with specific aspects of the genesis work adjustment programming. Work is currently underway to complete a treatment module on "Analysing Performance Problems in Work Adjustment Programming."

The initial concentration of matching a functional disability with a specific treatment is on performance problems in work adjustment programming. Assessment includes observation of on-task/off-task behaviors in relation to production measures. Specific treatment module to be tested is the pacing of performance through electronic instrumentation. Procedures for analyzing performance problems are currently being devised and application of these procedures at field sites is being arranged. Initial pilot studies indicate increase in production, but performance of these changes has not been assessed.

414 The Effects of Vocational Evaluation on Client Vocational Awareness, Attitude and Competency

Principal Investigator:	Fredrick Menz, Ph.D.	
FY 1976		
Status:	Continuing	
Dates:	September, 1974-September, 1976	
Cost:	Annual $6,305 RT Annual $4,943	Projected Total $15,887 RT % of Annual Total 78%
Annual Report Reference:	#4, Page 74, R-23	
FY 1977		
Status:	**Continuing**	
Dates:	**September, 1974-June, 1977**	
Cost:	**Annual $5,036** **RT Annual $3,592**	**Projected Total $17,823** **RT % of Annual Total 71%**
Annual Report Reference:	**#5, Page 99, R-23**	

OBJECTIVE: The Wisconsin Division of Vocational Rehabilitation has set up a demonstration project entitled Concentrated Assessment and Diagnosis in Rehabilitation Entrance at the Waukesha Office. This project has been set up to determine the advantages of early assessment of the severely disabled in their rehabilitation. Consistent with this objective are aims which include reduction in costs for and improved quality of evaluation and more effective utilization of community resources. The focus of the project is on reducing the time delay between referral for evaluation and assessment of clients by basing a Singer Vocational Evaluation System in the office and locating a JEVS System at the Waukesha Training Center. The Center's emphasis in this effort is to determine the immediate effects of vocational evaluation on client vocational orientation.

METHODOLOGY:

a. Samples: Samples for this study include all counselors at the Waukesha office and all clients entering the Waukesha office between December 19, 1974 and March 1, 1976 and referred for vocational evaluation.

Counselors provide ratings on behaviors of all clients referred to vocational evaluation during this period. Counselor referrals will be "natural", i.e., no attempt will be made to impose structure on the referral process. Both estimates of client functioning and direct measures of their vocational attitudes and competencies will be blocked during the analysis stage on disability and sex characteristics.

b. Variables: Client demographic variables as sex, disability, referral source, funds expended, and risk group classification are being collected from office records. Counselor demographic variables as sex, experience, and referral patterns will also be collected.

The dependent variables are client vocational awareness, client vocational attitude, and client vocational competency.

Procedures: At referral, counselors rank each awareness area in terms of its relative importance as an effect of vocational evaluation on the client. Immediately after the counselor's first contact with the client, subsequent to vocational evaluation and prior to receiving the evaluation report, the counselor rates the client's functioning in each awareness area. If the client is referred to the office-based evaluation, the evaluator independently estimates the client's level of functioning in each area.

The effects of vocational evaluation on client attitude and competency will be estimated in a "separate sample pretest-post-test design." Clients referred to the office-based unit are randomly assigned to a pre-or post-testing with the CMI.

Demographic data on clients and counselors will be employed in the analysis of the data collected on clients referred to vocational evaluation to most adequately explain measured effects. The effects of vocational evaluation on client vocational awareness will be studied in a Program Sex Disability factorial analysis of variance design. Effects of vocational evaluation on attitude and competency will be studied in Sex Disability repeated measures analysis of variance design.

PROGRESS AND FINDINGS: Site Visits have been made to jointly plan the project with RRRI and Waukesha office staff and for implementation with the counselors and the vocational evaluators. Analysis of data is now proceeding.

415 Telecommunications in Training of Rehabilitation Facility Personnel

Principal Investigator:	Charles Coker, Ph.D.	
FY 1976		
Status:	New	
Dates:	August, 1975-June, 1976	
Cost:	Annual $1,839 RT Annual $1,441	Projected Total $5,439 RT % of Annual Total 78%
Annual Report Reference:	#4, Page 106, R-24	
FY 1977		
Status:	**Continuing**	
Dates:	**September, 1975-June, 1978**	
Cost:	**Annual $8,392** **RT Annual $5,985**	**Projected Total $24,304** **RT % of Annual Total 71%**
Annual Report Reference:	**#5, Page 275, R-24**	

OBJECTIVES: This project's purpose is the developmental and implementation of an innovative technique to enhance the training and research of the Center. The objectives are to determine: a) the availability and costs of telecommunications systems or equipment most compatible with the training and/or research needs of the Center. b) Potential and actual benefits to training and research of the Center.

METHODOLOGY: The mechanics of the project consists of three phases:

I. Planning Factors — Determining telecommunication systems and equipment costs, advantages, disadvantages, and Center needs.
II. Demonstration Factors — Site arrangements, training material selection, and evaluation of training via telecommunication.
III. Implementation Factors — Cost/benefit analysis based on Phase I & II to determine optimal system for Center needs.

FINDINGS TO DATE: Phase I has been completed in terms of exploring various telecommunications equipment and systems. From this information, the Center has devised a tentative system relying on conference telephones of two types:

1) Telephone company conference telephones requiring installation and rental costs.
2) The Center's own cradle-type telephone conference unit requiring no installation.

The training specified above will enable the Center to maintain semi-permanent satellite training/research sites plus the flexibility of responding to short term needs. Either unit can be used with ten different sites and is suitable for small groups of 10-20 individuals. More than twenty individuals at a site may require external amplification devices. Phase II is currently underway and preliminary testing has proven satisfactory. This project is expected to reduce training/research travel costs, while at the same time increase quality and breadth of training/research.

416 Development of a Competency-Based Staff Development Program for Vocational Evaluators and Adjustment Specialists

Principal Investigator: Dennis J. Dunn, Ed.D.
Status: New
Dates: July, 1975-December, 1977
Cost: Annual $722 Projected Total $3,600
RT Annual $566 RT % of Annual Total 78%
Annual Report Reference: #4, Page 112, R-25
Principal Investigator: Charles C. Coker, Ph.D.
FY 1977
Status: Continuing
Dates: July, 1975-June, 1978
Cost: Annual $8,392 Projected Total $36,037
RT Annual $5,985 RT % of Annual Total 71%
Annual Report Reference: #5, Page 283, R-25

OBJECTIVES: The study is directed toward assessing the competency needs and levels of vocational evaluators and work adjustment personnel to provide quality services to the handicapped. The objectives are as follows:

1. To coordinate action with various professional groups and training/education facilities to provide input into the project's design and relevancy, to avoid duplication of effort and to disseminate project's findings.
2. To ascertain competency statements which reflect the task requirements of the vocational evaluation and work adjustment specialist.
3. To determine the relative importance of competency statements in relation to job requirements.

METHODOLOGY: The procedure involves devising a questionnaire containing competency statements concerning vocational evaluators and work adjustment specialist job requirements, having a select sample rate the importance of these statements, analyzing data for significance and common task requirements, and repeating the procedure as necessary to refine the data for meaningful impact to training/education programs and professional groups.

FINDINGS TO DATE: An initial statement pool of over 2500 competency items has been screened and reduced to 175 competency statements relating to vocational evaluator task requirements. The statements were administered to groups of 116 rehabilitation educators, students, and practicing vocational evaluators who were asked to rate the importance of each statement and indicate where that skill could best be acquired. Biographical data was collected on each respondent and reliability checks were made on the ratings. At present, these data are being analyzed for significance. These data were generated through the efforts of National Consortium for performance based training sponsored by Auburn University and the University of Georgia.

417 Factors Influencing Counselors Determination of Client Eligibility and Referral for Facility Services

FY 1976 Status:	Proposed	
Principal Investigator:	**Charles C. Coker, Ph.D.**	
FY 1977		
Status:	**Continuing**	
Dates:	**March, 1977-October, 1979**	
Cost:	**Annual $3,360** **RT Annual $2,396**	**Projected Total $137,450** **RT % of Annual Total 71%**
Annual Report Reference:	**#5, Page 160, R-26**	

OBJECTIVES: The primary goal of this project is to reduce knowledge gaps with respect to eligibility determination and to generate new knowledge which would result in decreasing time, cost, and errors currently incurred in eligibility determination. Specifically the project examines the decision-making process of the VR counselors and the exchange of information via referral requests and reports. The objectives of the study are to determine:

1. Whether the sequence and number of informational reports effect outcome eligibility decisions.
2. Whether there exists certain optimal patterns and types of information that affect decisions.
3. Whether critical content statements within a report bias the decision-making process.
4. What factors affect the referral requests.
5. What factors affect the interpretation of the referral report.

METHODOLOGY: The methodology to accomplish the objectives is too complex to detail. The procedures center on the use of simulated cases containing twenty informational medical, vocational, psychological, and casenotes which are processed by the subjects in relation to eligibility determination and referral to rehabilitation services. For each of the objectives, the simulated case format is used in a different way to address the question involved. Detailed information can be found in the Center's Progress Report #5.

FINDINGS TO DATE: From a prior study, it was found that VR counselors use anywhere from 3 to 14 referral requests prior to making an eligibility decision. However, the number, type, and sequence of selecting reports does not appear to affect the eligibility decision. The present study is to examine factors in the content of the report on referral system which bears most heavily on the decisions of eligibility and service referrals.

PERMUTED SUBJECT INDEX

A
ABOVE-KNEE AMPUTATION – see AMPUTATION
ABILITY
Assessing Vocational Aptitudes Using a Task Performance Rating Scale 407
ACADEMIC PROGRAM
Crisis Intervention Rehabilitation Applied Research Program for the Severely Develop 258
Development of Videotapes for Application in Training Rehabilitation Counselors to W 344
Effective Training in Rehabilitation Medicine in New Medical School Curricula 358
Effective Training in Rehabilitation Medicine in New Medical School Curricula 185
Evaluation of Halfway House Training Programs for the Mentally Retarded 390
Longitudinal Study of the Social, Vocational, Legal and Family Status of Young Adult 259
Process and Outcome in Cooperative School Programs in Texas 404
Study of the Development and Change of Attitudes of Medical Students Throughout 040
Training Evaluation Kit 323
ACCESS
Project Access 215
ACCOUNTABILITY
Nursing Home Continuing Education Accountability 088
Method for Enhancing Accountability 031
Rehabilitation Indicators, a Method for Enhancing Accountability 112
ACTIVITY – see ACTIVITY OF DAILY LIVING
PHYSICAL ACTIVITY
ACTIVITY OF DAILY LIVING
Community-Based Maintenance Care for the Long-Term Patient (Planning Grant to De 166
Community Group Homes for the Developmentally Disabled 318
Computer Retrieval of Data for Long Range Evaluation Studies of Medical Rehabilitat 180
Cost Analysis and Program Budgeting of Community Residential Facilities and Rehab 320
Development and Evaluation of a Systematic Physical Fitness Training Program for 278
Development of a Measurement Tool for Placements in Care Facilities 066
Development of a Model for Evaluating the Relationship Between EMR Work/Study Pr 317
Development of Transfer Devices for High Quadriplegic Patients 038
Effects of Special Olympics Participation on Retarded Children, Families, and Comm 401
Engineering Analysis and Evaluation of a New Radial Palsy Splint 169
Evaluation of a Physical, Intellectual, and Emotional Personal Adjustment Training Prog 275
Evaluation of the Relationship of Self-Care Outcomes to Care in the Acute Hospital, th 055
Evaluation of Retarded Student Achievement in Career Education Programs 329
Factors Underlying Successful Adjustment of the Retarded Released from Institutions 400
Follow-Along Study of a Medically Disabled Population in Fall River, Massachusetts, 179
Follow-Along Study of Clients Returned for Service to a State Rehabilitation Agency 170
Functional Achievement Evaluation RIC Tenodesis Splint 375
Functional, Social and Vocational Assessment of Surviving Persons with Documented 174
Home Management Education for the Mentally Retarded 255
Job Development and Enhanced Productivity for Severely Disabled 218
Measuring Client Gain in Group Homes for the Retarded 321
Motor Unit Composition and Voluntary Force in Neuromuscular Disease 201
Project to Document the Development of a Cooperative Group Residence for Severel 184
Project to Provide Systematic Follow-Along to Persons Medically Rehabilitated in Fall 167
Research Needs in Vocational Rehabilitation 327
Response Oriented Sensory Aid for Assessment and Treatment of Oculomotor Dysfun 197
Social and Community Living Skill Training of Mentally Retarded Adults, a Comp 395
Sociological Look at the Impact of Normalization 328
Study of Factors Related to Personal Independence Gains of Spinal Cord Injured Patie 142
Visual System Disorders and Functional Correlates 200
ADAPTATION
Clinical Assessment of Psychological Adjustment to Spinal Cord Injury 365
Crisis Intervention Rehabilitation Applied Research Program for the Severely Developme 258
Evaluation of Retarded Student Achievement in Career Education Programs 329

- Follow-Along Study of Clients returned for Service to a State Rehabilitation Agency 170
- Functional Achievement Evaluation RIC Tenodesis Splint 375
- Job Development and Enhanced Productivity for Severely Disabled 218
- Measuring Client Gain in Group Homes for the Retarded 321
- Predictor Feedback Technology for Electromyographic Control of Prosthetic and Orth 173
- Program for the Analysis of Deinstitutionalization Resources 319
- Project to Document the Development of a Cooperative Group Residence for Seve 184
- Role of Family in Institutional Rehabilitation of Clients with Behavioral and Physical 220
- Sociological Look at the Impact of Normalization 328
- Study of the Development and Change of Attitudes of Medical Students Throughout the 040
- Technology Assessment, Human Rehabilitation Techniques 403

ADDICTION – see DRUG ABUSE

ADJUSTMENT
- Contributions of Personal Achievement Skills to Work Adjustment Training 279
- Differential Treatment of Functional Disabilities in Work Adjustment Programming 413
- Evaluation of Efficacy of Rehabilitation Programs 052
- Identification of Work Reinforcers Found in Sheltered Workshops and Their Relations 410
- Research on the Psychosocial and Vocational Adjustment of Spinal Cord Injured Clie 285

ADL – see ACTIVITY OF DAILY LIVING

ADOLESCENT – see CHILDREN

ADRENAL – see HORMONE

ADULT
- Adult Basic Education for the Mentally Retarded 253
- Application of Dynamic Palatography in Organic Speech Disorders 195
- Community Group Homes for the Developmentally Disabled 318
- Controlled Study of Inhalational Therapy in the Rehabilitation of Patients with Chronic 001
- Cost Analysis and Program Budgeting of Community Residential Facilities and Rehab 320
- Crisis Intervention Rehabilitation Applied Research Program for the Severely Develop 258
- Effects of Different Types of Frustrating Conditions on the Behavior of Institutionalized M 252
- Factors Underlying Successful Adjustment of the Retarded Released from Institutions 400
- Follow-Along Study of Clients Returned for Service to a State Rehabilitation Agency 170
- Functional, Social and Vocational Assessment of Surviving Persons with Documented 174
- Home Management Education for the Mentally Retarded 255
- Investigation of the Mentally Retarded Clients Both Rehabilitated and Nonrehabilitat. 256
- Predicting Rate of Acquisition and Production of Complex Industrial Tasks by Institutio 322
- Prognosis in Recovery From Aphasia 228
- Program for the Analysis of Deinstitutionalization Resources 319
- Sociological Look at the Impact of Normalization 328
- Study of Cortical Organization Using Visual and Somatosensory Evoked Potentials 217
- Study of the Development and Change of Attitudes of Medical Students Throughout th 040
- Supervision in Vocational Rehabilitation 326

ADVOCACY
- Consumer Advocacy Project 171
- Evaluation of Three Citizen Advocacy Programs 396

AGED
- Functional, Social and Vocational Assessment of Surviving Persons With Document 174
- Regulation of Regional Intracerebral Circulation During Injury and Aging 018
- Studies of Urologic Function in Patients Following Spinal Cord Injuries 045
- Study of Cortical Organization Using Visual and Somatosensory Evoked Potentials 217

AGENCY
- Crisis Intervention Rehabilitation Applied Research Program for the Severely Developm 258
- Determining the Feasibility of a National Cooperative for the Development and Distrib 336
- Factors Underlying Successful Adjustment of the Retarded Released from Institutions 400
- Follow-up Study of Rehabilitation Short-Term Training 325
- Investigation of the Mentally Retarded Clients Both Rehabilitated and Nonrehabilitated 256
- Program Evaluation Techniques in Vocational Rehabilitation Agencies and Facilities 301
- State Rehabilitation Agency as a System Serving Community Hospital Patients 351
- Supervision in Vocational Rehabilitation 326

  - Survey of Staff Development Activities in State Rehabilitation Agencies 283
  - Survey of the Subsystems in the State Rehabilitation Agency District Office 352
- AGGRESSION – see BEHAVIOR
- AGING – see AGED
- AIR CYSTOMETRY – see DIAGNOSIS
- AIR POLLUTION – see ENVIRONMENT
- ALCOHOL – see ALCOHOLISM
- ALCOHOLISM
  - Alcohol – Film Bibliography 282
  - Factors Associated With Successful Rehabilitation of Handicapped Individuals of Vario 305
  - Family Factors in the Recurrence and Maintenance of Alcoholism and Other Chronic 214
  - Role of Family in Institutional Rehabilitation of Clients With Behavioral and Physical 220
- ALDOSTERONE – see HORMONE
- ALLIED HEALTH PERSONNEL – see also PERSONNEL
  - Assessment and Evaluation of Home Health Team Activities 372
  - Brown University-VR-CHIP-RT-7 Program 189
- ALLIED HEALTH WORKER – see ALLIED HEALTH PERSONNEL
- ALTITUDE – see ENVIRONMENT
- AMBULATION
  - Clinical Classification and Functional Prediction, a Study of the Stroke Population 205
  - Cognitive Assist in Motor Learning 156
  - Development of a Model Demonstration Rehabilitation Service 203
  - Effects of Special Olympics Participation on Retarded Children, Families, and Commu 401
  - Energy Expenditures While Performing Normal Street Walking – A Comprehensive Study 366
  - Externally Controlled Modification of the Impaired Ambulation of Hemiparetic Patients 130
  - Functional, Social and Vocational Assessment of Surviving Persons With Documented 174
  - Fundamental Study of Human Locomotion 190
  - Improvement of Function of Spastic and Stroke Patients by Means of Biofeedback 158
  - Incorporation of a Lexan Check Socket into a Definitive Patellar Tendon Bearing Prosth 114
  - Lateral Postural Control and Locomotor Performance in Normal Subjects and Patients 194
  - Motor Control and its Relationship to Functional Activities 202
  - Postural Control in the Initiation of Gait, Normal and Pathological Mechanisms 196
  - Quantification of the Biomechanical Function of Various Designs and Adjustments of A 101
  - Research Developments of Lower Extremity Orthotic Systems for Patients With Various F 124
  - Research in Upper and Lower Extremity Orthotics 177
  - Role of Feedback in Control of Motor Function 198
  - Short Leg Bracing in Selected Cases of Crouch Gait 093
  - Technology Assessment: Human Rehabilitation Techniques 403
- AMERICAN REHABILITATION ASSOCIATION – see AGENCY
- AMERICAN REHABILITATION COUNSELING ASSOCIATION – see AGENCY COUNSELING
- AMP – see ENERGY COMPOUND
- AMPUTATION
  - Energy Expenditures While Performing Normal Street Walking – A Comprehensive Study 366
  - Incorporation of a Lexan Check Socket Into a Definitive Patellar Tendon Bearing Prosth 114
  - Orthotics and Prosthetics Design Improvements 024
  - Pathomechanics of Upper Limbs as a Basis for Improved Prosthetic and Orthotic Desig 033
  - Predictor Feedback Technology for Eelectromyographic Control of Prosthetic and Orth 173
- AMPUTEE – see AMPUTATION
- ANAL SPINCTER – see MUSCLE STUDY
- ANALYSIS – see EVALUATION
- ANIMAL EXPERIMENTATION
  - Severe Disabling Polyneuritis of Unknown Cause, the Development of a Research Mod 099
  - Effects of Specific Cutaneous Cold Stimulation on Motor Control in Cat and Man 150
  - Homotransplantation of Total Hip Joint Articular Cartilage in Dogs 176
  - Role of Neurotransmitters in Spacticity Genesis 379

ANISOMELIA – see EXTREMITY
ANKLE – see EXTREMITY and JOINT
ANTIHISTAMINE – see DRUG THERAPY, THERAPY
ANTISEPTIC – see PATHOGENIC BACTERIA
ANTISPASTIC DRUG – see also DRUG THERAPY
SPASTICITY
THERAPY
Further Studies of the Patho-physiology of Spasticity 192
Scientific and Clinical Testing of New Experimental Drugs 161
ANTITHROMBIN II – see DRUG THERAPY
THERAPY
VASCULAR DISORDER
APHASIA – see BRAIN DISORDER and SPEECH DISORDER
APNEA – see RESPIRATORY DISORDER
APRAXIA – see COORDINATION
ARCHITECTURAL BARRIER – see BARRIER
ARM – see EXTREMITY
ARTERIOSCLEROSIS – see also VASCULAR DISORDER
Black Language Studies 175
Natural History of Deep-Vein Thrombosis in the Spinal Cord Injured 386
Objective Evaluation of Lower Limb Blood Flow and Circulatory Reflexes in Patients 015
Technology Assessment: Human Rehabilitation Techniques 403
ARTHRITIS – see also JOINT
Comparison of Two Dosage Schedules of Gold in the Treatment of Rheumatoid 136
Technology Assessment: Human Rehabilitation Techniques 403
Value of LDH Isoenzyme Studies in Collagen Disease 064
ARTHOROGRYPOSIS – see JOINT
ARTICULATION – see SPEECH
ASOCIAL BEHAVIOR – see BEHAVIOR
ASSESSMENT-see EVALUATION
ASTHMA – see RESPIRATORY DISORDER
ATAXIA – see AMBULATION
ATHETOID
Technology Assessment, Human Rehabilitation Techniques 403
Training Program for Upper Extremity Activities in Athetoid Patients 049
ATP – see ENERGY COMPOUND
ATTENTION – see BEHAVIOR
ATTITUDE – see also BEHAVIOR
Facilitative Staff Attitudes Toward Disabled Persons 261
Counselor Psychological Change Following In-Service Training and Client Contact 265
Rehabilitation/Public Assistance Worker Attitudes and Client Outcome 264
AUDIOLOGY – see HEARING
AUDIOTAPE – see AUDIOVISUAL AID
AUDIOVISUAL AID – see also TEACHING TOOL
Determining the Feasibility of a National Cooperative for the Development and Distrib 336
Development and Application of New Testing Procedures to the Study of Captions 334
Developing an Empirically Based Training Program in Mental Retardation 397
Development of Standards and Principles for Visual Displays for Deaf Persons. The Vis 330
Development of Videotapes for Application in Training Rehabilitation Counselors to W 344
National System for Job Development in Micrographics 207
Preliminary Investigation of Micrographic Viewer for Use by Disabled Persons 371
Studies of Urologic Function in Patients Following Spinal Cord Injuries 045
Technology Assessment: Human Rehabilitation Techniques 403
AUDITORY – see HEARING
AUDITORY DISORDER – see DEAF
DEAF-BLIND
HEARING

AUTOMATED TRAINING SYSTEM
  Evaluation of an Automatic Knee Locking Mechanism for a Knee Ankle Orthoses 075
AUTOMATIC KNEE LOCKING MECHANISM – see JOINT
  ORTHOSIS
  PROSTHESIS
AUTONOMIC PROCESSES
  Importance of Central and Peripheral Temperatures in Maintaining Euthermia in Patien 364
  Voluntary Control of Autonomic Processes Using Biofeedback and Reinforcement 056
AVERAGE EVOKED POTENTIALS
  Study of Cortical Organization Using Visual and Somatosensory Evoked Potentials 217

B

BACTERIA – see PATHOGENIC BACTERIA
BACTERIOPHAGE – see VIRUS
BACTERIURIA – see PATHOGENIC BACTERIA and URINARY DISORDER
BALANCE – see COORDINATION
BARRIER
  Crisis Intervention Rehabilitation Applied Research Program for the Severely Develop 258
  Effectiveness of Instructional Units in Describing Architectural Barriers for Residence 092
  Functional, Social and Vocational Assessment of Surviving Persons With Documente 174
  Job Development and Enhanced Productivity for Severely Disabled 218
  Overcoming Barriers to Deaf Persons in Federal Government 343
  Project Acces 215
  Reducing Public Barriers of the Severely Handicapped 377
  Semantic Analysis of Clinical Pain 102
  Technology Assessment: Human Rehabilitation Techniques 403
BASAL GANGLION – see NERVE STUDY
BEDRIDDEN – see also IMMOBILIZATION
  Black Language Studies 175
  Technology Assessment: Human Rehabilitation Techniques 403
BEDSORES – see PRESSURE SORE
  SKIN DISORDER
  ULCER
BEHAVIOR
  Analyzing Performance Competencies of Severely Handicapped Clients 314
  Behavioral Architecture, Ecological Designing of Facilities for the Mentally Retarded 389
  Contributions of Personal Achievement Skills to Work Adjustment Training 279
  Counselor Psychological Change Following In-Service Training and Client Contact 265
  Crisis Intervention Rehabilitation Applied Research Program for the Severely Develop 258
  Differential Appreciation of Color and Form by Young Children 246
  Differential Treatment of Functional Disabilities in Work Adjustment Programming 413
  Enhancing the Responsiveness of the Rehabilitation Service Delivery System to the 304
  Facilitative Staff Attitudes Toward Disabled Persons 261
  Factors Influencing Patient Compliance in Patients With Ischemic Heart Disease 221
  Functional, Social and Vocational Assessment of Surviving Persons With Document 174
  Investigation of the Mentally Retarded Clients Both Rehabilitated and Nonrehab 256
  Handbook of Behavior Management Procedures for Psychsocial Problems in Rehab 260
  Live Adjustment Post Myocardial Infarction Defining Predictive Variables 213
  Longitudinal Analysis of Patient Behavior 139
  Longitudinal Study of the Social, Vocational, Legal, and Family Status of Young 259
  Oddity Discrimination in Young Children 245
  Process and Outcomes of Vocational Evaluation Services 412
  Reducing Public Barriers of the Severely Handicapped 377
  Rehabilitation/Public Assistance Worker Attitudes and Client Outcome 264
  Role of Family in Institutional Rehabilitation of Clients With Behavioral and Physical 220
  Sexual Function in Physical Disability 041
BEHAVIOR MODIFICATION
  Behavior Modification, a Problem-Oriented, Learning-Based Research Strategy for 061

  Contingency Management Systems in Medical Rehabilitation 080
  Contributions of Personal Achievement Skills to Work Adjustment Training 279
  Cooperation and Competition Skills of the Institutionalized Mentally Retarded 393
  Crisis Intervention Rehabilitation Applied Research Program for the Severely Develop 258
  Development and Evaluation of a Set of Systematic Training Units to Increase or 298
  Differential Treatment of Functional Disabilities in Work Adjustment Programming 413
  Effects of Different Types of Frustrating Conditions on the Behavior of Institutionalized 252
  Enhancing the Responsiveness of the Rehabilitation Service Delivery System to the 304
  Follow-up Study of Patients Treated in the Pain Treatment Program Physical Medi 062
  Handbook of Behavior Management Procedures for Psychsocial Problems in Rehab 260
  Operant Conditioning Methods in Management of Chronic Pain 079
  Predicting Rate of Acquisition and Production of Complex Industrial Tasks by Institu 322
  Social and Community Living Skill Training of Mentally Retarded Adults, a Comp 395
  Study of Emotional Forces in Psychogenic Asthma 216
BEHAVIORAL ARCHITECTURE
  Behavioral Architecture, Ecological Designing of Facilities for the Mentally Retard 389
BEHAVIORAL COMPETENCY
  Identification of Factors Affecting Behavioral Competency in a Comprehensive 302
BEHAVIORAL MEASURES
  Rehabilitation Indicators, a Method for Enhancing Accountability 112
BEKESEY AUDIOMETRY—see HEARING
BELL'S PALSY—see also FACIAL DISORDER, NERVE DISORDER, PALSY
  Etiology, Prognosis, and Effects of Treatment in Bell's Palsy 165
BENEFITS — COST ANALYSIS
  Simplified Model for Cost-Benefit Analysis in Rehabilitation Programs 313
BENEFITS, PUBLIC
  Overcoming Disincentives to the Rehabilitation of SSI and SSDI Beneficiaries 367
BERKO MORPHOLOGY—see SPEECH
BIBLIOGRAPHY—see also INFORMATION ACTIVITY, LITERATURE SURVEY
  Alcohol-Film Bibliography 282
  Bibliography of Psychosocial, Vocational, and Sexual Aspects of Spinal Cord 058
  Review and Analysis of Drug Treatment Literature 268
  Serving Deaf Rehabilitation Clients, Fundamentals of Communication 273
  Studies of Urologic Function in Patients Following Spinal Cord Injuries 045
BIOCHEMISTRY
  Bone Mineralization in Spinal Cord Injured Man, a Biochemical and Radiologic 025
  Postoperative Care of Patients with Total Hip Joint Replacement Using Ultrasound 096
  Sympathetic Activity and the Metabolism of Biogenic Amines in Spinal Cord Injured 026
  Value of LDH Isoenzyme Studies in Collagen Disease 064
BIOELECTRIC FEEDBACK DEVICE—see BIOFEEDBACK
  REHABILITATION DEVICE
BIOENGINEERING
  Assessment of Driving Capabilities of the Brain Injured Population 206
  Comparative Clinical Evaluation of Several EMG Processing Techniques 164
  Development and Evaluation of Automatic Warning Device to Help Prevent Pressure 359
  Development of a Model Demonstration Rehabilitation Service 203
  Development of a System for Determination of Frequency and Volume of Urination in 356
  Early Adjustment to Steady and Unsteady Exercise in Patients with Cardio-pulmo 232
  Echocardiographic Assessment of Ventricular Motion During Exercise 234
  Energy Expenditures While Performing Normal Street Walking—A Comprehensive 366
  Engineering Analysis and Evaluation of a New Radial Palsy Splint 169
  Evaluation of a Sonic Urinimeter for Blind Diabetics 149
  Importance of Central and Peripheral Temperatures in Maintaining Euthermia in 364
  Linguaplatal Cues as an Aid to Consonant Articulation in Deaf Adults 373
  Motor Control and its Relationship to Functional Activities 202
  Predictor Feedback Technology for Electromyographic Control of Prosthetic and 173
  Preliminary Investigation of Micrographic Viewer for Use by Disabled Persons 371

- Role of Feedback in Control of Motor Function 198
- Technology Assessment: Human Rehabilitation Techniques 403

BIOFEEDBACK
- Control of Spasticity with EMG Biofeedback in the Incomplete Spinal Cord Injured 111
- Controlled Study of the Use of Temperature Feedback for the Treatment of 107
- Effectiveness of EMG Muscle Relaxation Training as a Function of Feedback Mode 108
- Electromyograplic Activity in Chronic Tension States 076
- Electromyographic Feedback in the Training of Persons who are Hemiplegic 095
- Evaluation of Methods and Aids Used in Gait Training 073
- Improvement of Function of Spastic and Stroke Patients by Means of Biofeedback 158
- Linguaplatal Cues as an Aid to Consonant Articulation in Deaf Adults 373
- Modification of Nasality in Utterances of Deaf Speakers 360
- Predictor Feedback Technology for Electromyographic Control of Prosthetic and 173
- Role of Feedback in Control of Motor Function 198
- Use of EMG Feedback in the Treatment of Chronic Tension States 078
- Voluntary Control of Autonomic Processes Using Biofeedback and Reinforcement 056

BIOLOGICAL RHYTHM – see CIRCADIAN RHYTHM

BIOMECHANICS
- Correlative Kinesiology 016
- Engineering Analysis and Evaluation of New Radial Palsy Splint 169
- Homotransplantation of Total Hip Joint Articular Cartilage in Dogs 176
- Incorporation of a Lexan Check Socket into a Definitive Patellar Tendon Bearing 114
- Motor Control and its Relationship to Functional Activities 202
- Postural Control in the Initiation of Gait, Normal and Pathological Mechanisms 196
- Quantitative Studies of Muscular Strength and Muscular Work 050
- Role of Feedback in Control of Motor Function 198
- Sequential Circulatory Assist 007
- Spinal Muscular Tone of Scoliosis Patients in Siblings 151
- Technology Assessment: Human Rehabilitation Techniques 403
- Variable Inclination Mattress 008

BIOPSY – see DIAGNOSIS

BIRTH DEFECTS
- Health Services for Developmentally Disabled Adults 376

BLACK – see MINORITY GROUP

BLACK DIALECT – see also MINORITY GROUP
- Berko Morphology 241
- Bibliography of Language Acquisition and Black Dialect 248
- Black Language Studies 175
- Free Speech Language Analysis 239

BLACK LUNG – see RESPIRATORY DISORDER

BLADDER – see URINARY BLADDER

BLADDER DISORDERS
- Attempted Dissolution of Struvite (MGNH4PO4 6H20) Urinary Calculi 131
- Clinical Studies of Calcium in Quadriplegia Collagen Metabolites and Bone 138
- Electromyographic Findings in the Upper and in the Lower Motor Neuron Diseases: 355
- Day Care Pulmonary Rehabilitation Program Evaluation 381
- Effect of Disodium Etidronate on the Recurrence of Ectopic Calcification Following 361
- Renal Scintillation Camera Studies as a Method of Following Renal Function and 368
- Prevention of Urinary Tract Infection in Spinal Cord Injury 385
- Overcoming Disincentives to the Rehabilitation of SSI and SSDI Beneficiaries 367
- Studies of Urologic Function in Patients Following Spinal Cord Injuries 045
- Process and Outcomes of Vocational Evaluation Services 412
- Treatment of the Neurogenic Dysfunctional Bladder by Implantable Artificial 144
- Use of Acetohydroxamic Acid (AHA) in Humans 135
- Use of an Intraurethral Catheter to Provide Urinary Drainage 128

- BLADDER MANAGEMENT – see also ACTIVITY OF DAILY LIVING
  - Long-Term Follow-up Studies of Patients with Spinal Cord Injury who Became 369
- BLIND
  - Application of Personal Achievement Skills to Personal Adjustment Training for the 292
  - Counselor Psychological Change Following In-service Training and Client Contact 265
  - Identification of Deaf-Blind Individuals and the Development of Education & 392
- BLOOD
  - Antithrombin III in Ischemic Thrombotic Vascular Disease 009
  - Structure and Function of Factor X 012
  - Hypercoagulable State in Thrombotic Disease 010
  - Ischemic Cerebrovascular Disease Study 011
  - Objective Evaluation of Lower Limb Blood Flow and Circulatory Reflexes in Patients 015
  - Regulation of Regional Intracerebral Circulation During Injury and Aging 018
- BLOOD COAGULATION TEST – see BLOOD and DIAGNOSIS
- BLOOD PRESSURE
  - Comprehensive Evaluation and Treadmill Exercise Testing in Treated Patients for 208
  - Effects of Special Olympics Participation on Retarded Children, Families, and 401
  - Black Language Studies 175
  - Physiologic Responses of Hemiparetic Patients to Specific Exercise Stress 168
  - Technology Assessment: Human Rehabilitation Techniques 403
- BODY BALANCE – see COORDINATION
- BODY POSITION – see POSTURE
  - PROPRIOCEPTION
- BONE – see also BONE DISORDER
  - Bone Mineralization in Spinal Cord Injured Man: A Biochemical and Radiologic 025
  - Effect of Disodium Etidronate (Diphosphonate) on Acute Osteoporosis 354
  - Effect of Disodium Etidronate on the Recurrence of Ectopic Calcification 361
  - Effects of Ultrasound on Bone Healing 067
  - Treatment of Myositis Ossificans and Calcinosis Universalis with Disodium Etidionate 087
- BONE DISORDER
  - Applications of the Evoked Electrospinogram 193
  - Bone Mineralization in Spinal Cord Injured Man: A Biochemical and Radiologic 025
  - Clinical Studies of Calcium in Quadriplegia: Collagen Metabolites and Bone 138
  - Effect of Disodium Etidronate (Diphosphonate) on Acute Osteoporisis 354
  - Effect of Disodium Etidronate on the Recurrence of Ectopic Calcification 361
  - Effects of Ultrasound on Bone Healing 067
  - Technology Assessment: Human Rehabilitation Techniques 403
  - Treatment of Myositis Ossificans and Calcinosis Universalis with Disodium Etidionate 087
- BOWEL PROGRAM – see also ACTIVITY OF DAILY LIVING
  - Electronic Anal Sphincter Stimulation for Fecal Incontinence Control and Barium 036
  - Technology Assessment: Human Rehabilitation Techniques 403
- BRACE – see ORTHOSIS
  - PROSTHESIS
- BRAIN – see also BRAIN DISORDER
  - Functional Skills Remediation in Hemiplegia Assessment Model for Eye-Hand Skills 005
  - Functional, Social and Vocational Assessment of Surviving Persons with 174
  - Regulation of Regional Intracerebral Circulation During Injury and Aging 018
  - Remediation of Untreated Impairments 006
  - Study of Cortical Organization Using Visual and Somatosensory Evoked Potentials 217
- BRAIN DAMAGE – see BRAIN DISORDER
- BRAIN DISORDER – see also BRAIN
  - Assessment of Driving Capabilities of the Brain Injured Population 206
  - Computer Characterization of Patient Services 204
  - Diagnosis and Remediation of Deficits in Visual Information Processing and Verbal 035
  - Functional Skills Remediation in Hemiplegia Assessment Model for Eye-Hand Skills 005
  - Functional, Social and Vocational Assessment of Surviving Persons with 174
  - Motor Control and its Relationship to Functional Activities 202

Multi-Electrode Studies of Patients with Spastic Central Nervous System Disorders 199
Prognosis in Recovery from Aphasia 228
Regulation of Regional Intracerebral Circulation During Injury and Aging 018
Remediation of Untreated Impairments 006
Postural Control in the Initiation of Gait: Normal and Pathological Mechanisms 196
Rehabilitation Potential of Stroke Patients as a Function of Cerebral Lesion. 219
Technology Assessment: Human Rehabilitation Techniques 403
Temporal Factors in Recovery from Aphasia 017
Visual System Disorders and Functional Correlates 200

BRAIN INJURY – see BRAIN DISORDER
BREATH CONTROL – see RESPIRATION
BREATHING – see RESPIRATION
BRONCHIAL THERAPY – see RESPIRATION THERAPY
BRONCHITIS – see RESPIRATORY DISORDER
BROWN UNIVERSITY
Brown University – VR-CHIP-RT-7 Program 189

C

CALCIFICATION – see MINERAL
CALCIUM – see MINERAL
CANCER
Demonstration of Benefits of Early Identification of Psychosocial Problems and Early 029
Rehabilitation Needs of Cancer Patients 117
CAPTIONS
Development of Standards and Principles for Visual Displays for Deaf Persons. The Visual 330
Development and Application of New Testing Procedures to the Study of Captions and 334
CANE
Evaluation of Methods and Aids Used in Gait Training 073

CARDIAC CONDITIONING – see CARDIAC REHABILITATION

CARDIAC DISORDER
Clinical Application of Computer Scoring System of Electrocardiograms 226
Functiona[illegible] and Vocational Assessment of Surviving Persons with Documented 174
Portable Ex[illegible]onitoring System for Patients with Coronary Artery Disease 063
Serial Investiga[illegible]f Myocardial Infarction Patients using Non-invasive Techniques 225
Study of Cardia[illegible]k Evaluation and Reconditioning after Myocardial Inf[illegible]tion 046
Technology Assessm[illegible]: Human Rehabilitation Techniques 403

CARDIAC OUTPUT
Hypoxia and Cognitive Functions in Cardiovascular and Obstructive P[illegible]nary Diseas 235
Effects of Special Olympics Participation on Retarded Children, Famil[illegible] and Commu 401
Portable Exercise Monitoring System for Patients with Coronary Artery Disease 063
Study of Cardiac Work Evaluation and Reconditioning after Myocardial Infarction 046

CARDIAC PROGRAM
Controlled Evaluation of a Comprehensive Rehabilitation Program Immediately Follow 233
Portable Exercise Monitoring System for Patients with Coronary Artery Disease 063
Study of Cardiac Work Evaluation and Reconditioning after Myocardial Infarction 046

CARDIAC REHABILITATION
Clinical Application of Computer Scoring System of Electrocardiograms 226
Controlled Evaluation of a Comprehensive Rehabilitation Program Immediately Follow 233
Early Adjustment to Steady and Unsteady Exercise in Patients with Cardiopulmonary Disab 232
Echocardiographic Assessment of Ventricular Motion During Exercise 234
Evaluation of Exercise after Myocardial Infarction National Exercise and Heart Disease Proj 155

Exercise and Lipid Profile in Ischemic Heart Disease 137
Factors Influencing Patient Compliance in Patients with Ischemic Heart Disease 221
Field Testing of a Cardiac Evaluation Technique for Counselor use in Vocational 230
Hypoxia and Cognitive Functions in Cardiovascular and Obstructive Pulmonary Diseas 235
Live Adjustment Post Myocardial Infarction Defining Predictive Variables 213
Physiologic Responses of Hemiparetic Patients to Specific Exercise Stress 168
Portable Exercise Monitoring System for Patients with Coronary Artery Disease 063
Serial Investigation of Myocardial Infarction Patients using Non-invasive Techniques 225
Study of Cardiac work Evaluation and Reconditioning after Myocardial Infarction 046
Technology Assessment: Human Rehabilitation Techniques 403
Work Tolerance Evaluation Research and Training unit for a Cardiac Rehabilitation Progr 122

CARDIAC TOLERANCE
Physiologic Responses of Hemiparetic Patients to Specific Exercise Stress 168
Study of Cardiac Work Evaluation and Reconditioning After Myocardial Infarction 046
CARDIOVASCULAR-RESPIRATORY DISORDERS—see also RESPIRATORY DISORDERS
Antithrombin III in Ischemic Thrombotic Vascular Disease 009
Assessment of Hypoxia and Reduced Ventilitory Drive in Pulmonary Disability 227
Controlled Study of Inhalational Therapy in the Rehabilitation of Patients with Chronic 001
Effect of Environmental Factors and Geographic Location on Vocational Rehabilita 002
Electrocardiographic Monitoring with Telemetry During Physical Therapy 014
Factors Influencing the Right Heart Failure of Patients with Chronic Pulmonary Disease and 003
Hypercoagulable State in Thrombotic Disease 010
Ischemic Cerebrovascular Disease Study 011
Natural History of Deep-Vein Thrombosis in the Spinal Cord Injured 386
Structure and Function of Factor X 012
Technology Assessment: Human Rehabilitation Techniques 403
Use of Periodic Lung Expansion for the Facilitation and Rehabilitation and Prevention of 004
CARDIOVASCULAR STUDY—see HEART
CARDIOVASCULAR SYSTEM—see CARDIOVASCULAR-RESPIRATORY
DISORDER HEART
CARE—see HEALTH CARE
CAREER
Development of a Competency-Based Staff Development Program for Vocational 416
Development of a General Purpose Vocational Assessment Technique 388
Development of a Model for Evaluating the Relationship Between EMR Work/Study 317
Evaluation of Retarded Student Achievement in Career Education Programs 329
Explore Means of Utilizing the Severely Disabled Homebound to Pool Rehabilitation 209
Factors Underlying Successful Adjustment of the Retarded from Institutions 400
Follow-Along Study of Clients Returned for Service to a State Rehabilitation Agency 170
Functional, Social and Vocational Assessment of Surviving Persons with Documented 174
Job Development and Enhanced Productivity for Severely Disabled 218
National Interpreter Training Consortium 345
National System for Job Development in Micrographics 207
Opening Science Careers to the Handicapped 212
Predicting Rate of Acquisition and Production of Complex Industrial Tasks by Institutio 322
Project to Document the Development of a Cooperative Group Residence for Severe 184
Study of the Development and Change of Attitudes of Medical Students Throughout 040
CASE FINDING
Developing a Model for the Analysis of Case Movement in a Vocational Rehabilita 297
Factors Influencing Counselors Determination of Client Eligibility and Referral for Facilit 417
Factors Influencing Vocational Rehabilitation Counselor Utilization of Vocational 408
Functional, Social and Vocational Assessment of Surviving Persons with Documented 174
Identification of Patients Who Need Rehabilitation Services 348
Investigation of the Mentally Retarded Clients Both Rehabilitated and Nonrehabilitated or 256
Model Casefinding, Counseling and Referral Program for Deaf People 332

  - Overcoming Disincentives to the Rehabilitation of SSI and SSDI Beneficiaries 367
  - Use of Self-Instructional Training Material with Rehabilitation Personnel 286
- CASE MANAGEMENT – see also TRAINING
  - Facilitative Case Management in Rehabilitation 271
  - Rehabilitation Counseling: Development and Evaluation of a Comprehensive Counseling 299
- CASE RECORDS
  - Medical Information System as a Communication Link: The State Agency Medical Record 353
- CATECHOLAMINE – see BIOGENIC AMINE
- CATHETER
  - Electromyographic and Cystometrographic Study of Human Bladder 382
  - Evaluation of Long-Term Urinary Sterilization in Catheter-Free Paraplegics 362
  - Long-Term Follow-up Studies of Patients with Spinal Cord Injury who Became Catheter Free 369
  - Prevention of Urinary Tract Infection in Spinal Cord Injury 385
  - Studies of Urologic Function in Patients Following Spinal Cord Injuries 045
  - Use of an Intraurethral Catheter to Provide Urinary Drainage 128
- CATHERIZATION – see CATHETER
- CENSUS
  - Statistical Collection System for a Medical Rehabilitation Facility 181
  - Variables Related to the Attainment of Occupational Status Among Deaf Adults 340
- CENTRAL NERVOUS SYSTEM DISORDER
  - Computer Characterization of Patient Services 204
  - Electromyographic Findings in the Upper and in the Lower Motor Neuron Diseases: 355
  - Establishment of Normal Standards of the Spokes Test 172
  - Functional, Social and Vocational Assessment of Surviving Persons with Documented 174
  - Further Studies of the Patho-Physiology of Spasticity 192
  - Improvement of Function of Spastic and Stroke Patients by Means of Biofeedback 158
  - Multi-electrode Studies of Patients with Spastic Central Nervous System Disorders 199
  - Natural History of Deep-Vein Thrombosis in the Spinal Cord Injured 386
  - Physiologic Responses of Hemiparetic Patients to Specific Exercise Stress 168
  - Scientific and Clinical Testing of New Experimental Drugs 161
  - Studies of Urologic Function in Patients Following Spinal Cord Injuries 045
  - Study of Cortical Organization Using Visual and Somatosensory Evoked Potentials 217
  - Technology Assessment: Human Rehabilitation Techniques 403
  - Training Program for Upper Extremity Activities in Athetoid Patients 049
  - Quantitative and Qualitative Evaluation of Muscular Hypertonia in Patients with 047
- CEREBRAL HEMISPHERES – see BRAIN
- CEREBRAL PALSY – see PALSY
- CEREBROVASCULAR ACCIDENT – see STROKE
- CEREBROVASCULAR CIRCULATION – see BRAIN CIRCULATION
- CEREBROVASCULAR DISEASE – see BRAIN DISORDER
  - VASCULAR DISORDER
- CEREBROVASCULAR INSUFFICIENCY – see BRAIN DISORDER
  - VASCULAR DISORDER
- CHANGE STRATEGIES
  - State Rehabilitation Agency as a System Serving Community Hospital Patients 351
  - Survey of the Subsystems in the State Rehabilitation Agency District Office 352
- CHEEK MUSCLE – see FACIAL DISORDER
- CHEMOTHERAPY – see THERAPY
- CHEWING – see FACIAL DISORDER
- CHILDREN
  - Analysis of Longitudinally Derived Data by a Programmed Statistical Package 247
  - Application of Dynamic Palatography in Organic Speech Disorders 195
  - Development of Stimulus Material for Research and Teaching Apparatus 244
  - Effects of Special Olympics Participation on Retarded Children, Families, and Commu 401
  - Factors Underlying Successful Adjustment of the Retarded Released from Institutions 400
  - Head and Eye Position Training with a Visually Monitored Task 085

  Investigations of Validity and Clinical Use of Children's Hand Function Test 082
  Quantitative Studies of Muscular Strength and Muscular Work 050
CHOLESTEROL – see BIOCHEMISTRY
CHROMATOGRAPHY – see MUSCLE STUDY
CHRONIC DISABILITY
  Brown University-VR-CHIP-RT-7 Program 189
  Community-Based Maintenance Care for the Long-Term Patient (Planning Grant to De 166
  Computer Retrieval of Data for Long Range Evaluation Studies of Medical Rehabilitati 180
  Effect of Disodium Etidronate (Diphosphonate) on Acute Osteoporosis 354
  Effect of Disodium Etidronate on the Recurrence of Ectopic Calcification Following Sur 361
  Electromyographic Activity in Chronic Tension States 076
  Family Factors in the Recurrence and Maintenance of Alcoholism and Other Chronic 214
  Functional, Social and Vocational Assessment of Surviving Persons with Documented 174
  Health Services for Developmentally Disabled Adults 376
  Operant Conditioning Methods in Management of Chronic Pain 079
  Project to Provide Systematic Follow-Along to Persons Medically Rehabilitated in Fall 167
  Role of Family in Institutional Rehabilitation of Clients with Behavioral and Physical Dis 220
  Studies of Urologic Function in Patients Following Spinal Cord Injuries 045
  Technology Assessment: Human Rehabilitation Techniques 403
CHRONIC PAIN – see CHRONIC DISABILITY
  PAIN
CHRONIC TENSION – see CHRONIC DISABILITY
  STRESS
CHRONIC OBSTRUCTIVE PULMONARY DISEASE
  Assessment of Hypoxia and Reduced Ventilitory Drive in Pulmonary Disability 227
  Controlled Study of Inhalational Therapy in the Rehabilitation of Patients with Chronic 001
  Day Care Pulmonary Rehabilitation Program Evaluation 381
  Effect of Environmental Factors and Geographic Location on Vocational Rehabilitatio 002
  Factors Influencing the Right Heart Failure of Patients with Chronic Pulmonary Disease 003
  Technology Assessment: Human Rehabilitation Techniques 403
  Work Classification of Patients with Obstructive Pulmonary Diseases Following Rehabili 023
CIRCULATION – see also VASCULAR DISORDER
  Functional, Social and Vocational Assessment of Surviving Persons with Documented 174
  Natural History of Deep-Vein Thrombosis in the Spinal Cord Injured 386
  Sequential Circulatory Assist 007
  Studies of Urologic Function in Patients Following Spinal Cord Injuries 045
  Study of Cardiac Work Evaluation and Reconditioning After Myocardial Infarction 046
  Technology Assessment: Human Rehabilitation Techniques 403
  Voluntary Control of Autonomic Processes Using Biofeedback and Reinforcement Proc 056
CIVIL SERVICE – see also FEDERAL GOVERNMENT
  Overcoming Barriers to Deaf Persons in Federal Government 343
CLEFT PALATE – see FACIAL DISORDER
  SPEECH DISORDER
CLIENT
  Application of Personal Achievement Skills to Personal Adjustment Training for the Blind 292
  Assessing Vocational Aptitudes Using a Task Performance Rating Scale 407
  Cluster Analysis of Personality Characteristics of Rehabilitation Clients 281
  Community Group Homes for the Developmentally Disabled 318
  Comprehensive Evaluation of the Relationship between Disability and Personality Func 289
  Development and Evaluation of a Systematic Physical Fitness Training Program for Reh 278
  Cost Analysis of the Rehabilitation of Severely Disabled Deaf Clients 346
  Contributions of Personal Achievement Skills to Work Adjustment Training 279
  Cost Analysis and Program Budgeting of Community Residential Facilities and Rehabil 320
  Crisis Intervention Rehabilitation Applied Research Program for the Severely Developm 258
  Developing a Model for the Analysis of Case Movement in a Vocational Rehabilitatio 297
  Development and Evaluation of an Interpersonal Skills Training Package 288
  Development and Evaluation of a Self-Instructional Physical Fitness Training Program fo 293

- Development and Evaluation of a Set of Systematic Training Units to Increase or Decre 298
- Development of an Improved System for Measuring Client Outcome 290
- Development of a Valid Multiple-Factor Instrument to Assess Severity of Handicap 316
- Development of Videotapes for Application in Training Rehabilitation Counselors to Wo 344
- Dimensions of Rehabilitation Outcome: A Factor Analystic Study of Several Measures of 284
- Effects of Vocational Evaluation on Vocational Rehabilitation 309
- Evaluation of a Physical, Intellectual, and Emotional Personal Adjustment Training Progr 275
- Evaluation of the RIDAC (Rehabilitation Initial Diagnosis and Assessment for Clients) Proj 291
- Expanded Public Assistance/Vocational Rehabilitation Service for Rural Public Assistan 263
- Facilitative Case Management in Rehabilitation 271
- Facilitative Staff Attitudes Toward Disabled Persons 261
- Functional, Social and Vocational Assessment of Surviving Persons with Documented Co 174
- Handbook of Behavior Management Procedures for Psychsocial Problems in Rehabilitati 260
- Homogeneous Sub-Scales for the Mini-Mult 272
- Identification of Factors Affecting Behavioral Competency in a Comprehensive 302
- Identification of Patients Who Need Rehabilitation Services 348
- Investigation of the Mentally Retarded Clients Both Rehabilitated and Nonrehabilitate 256
- Measure of Suitability of Placement 280
- Model Casefinding, Counseling and Referral Program for Deaf People 332
- Overcoming Disincentives to the Rehabilitation of SSI and SSDI Beneficiaries 367
- Pattern-Probability Model for Predicting Client Outcome 270
- Rehabilitation Counseling: Development and Evaluation of a Comprehensive Counsel 299
- Rehabilitation of the End-Stage Renal Disease Client—Selected Readings 295
- Rehabilitation of the Rural Public Assistance Recipient at a Comprehensive Rehabilita 262
- Rehabilitation/Public Assistance Worker Attitudes and Client Outcome 264
- Replication of Eber's Multivariate Analysis of a Vocational Rehabilitation System 266
- Research Needs in Vocational Rehabilitation 327
- Research on the Psychosocial and Vocational Adjustment of Spinal Cord Injured Clie 285
- Review and Analysis of Drug Treatment Literature 268
- Serving Deaf Rehabilitation Clients: Fundamentals of Communication 273
- Sociological Look at the Impact of Normalization 328
- Systematic Psychosocial Vocational Treatment Strategies in Vocational Rehabilitation 300
- Towards a Placement System Empirically Established Through Criterion-Group 312
- R-300: A Vocational Rehabilitation Profile (A Model for Assessing How Vocational 307

CLIENT ASSESSMENT—see EVALUATION

CLIENT CHANGE—see EVALUATION
REHABILITATION GOAL

CLIENT OUTCOME—see REHABILITATION GOAL

CLINIC—see CLINICAL RESEARCH

CLINICAL RESEARCH

- Application of Dynamic Palatography in Organic Speech Disorders 195
- Clinical Classification and Functional Prediction: A Study of the Stroke Population 205
- Crisis Intervention Rehabilitation Applied Research Program for the Severely Developm 258
- Day Care Pulmonary Rehabilitation Program Evaluation 381
- Electromyographic and Cystometrographic Study of Human Bladder 382
- Follow-up Study of Patients Treated in the Pain Treatment Program: Physical Medicine 062
- Functional, Social and Vocational Assessment of Surviving Persons with Documented 174
- Investigation of the Mentally Retarded Clients Both Rehabilitated and Nonrehabilitated 256
- Live Adjustment Post Myocardial Infarction Defining Predictive Variables 213
- Natural History of Deep-Vein Thrombosis in the Spinal Cord Injured 386
- Physiologic Responses of Hemiparetic Patients to Specific Exercise Stress 168
- Pressure Ulcer Prediction and Prevention: A New Procedure 374
- Prevention of Urinary Tract Infection in Spinal Cord Injury 385
- Role of Family in Institutional Rehabilitation of Clients with Behavioral and Physical Disa 220
- Scientific and Clinical Testing of New Experimental Drugs 161
- Semantic Analysis of Clinical Pain 102
- Spinal Muscular Tone of Scoliosis Patients in Siblings 151

Studies of Urologic Function in Patients Following Spinal Cord Injuries 045
Study of Artifacts of Electrodiagnostic Testing in Severe Neurological Disabilities 083
Study of Cardiac Work Evaluation and Reconditioning After Myocardial Infarction 046
CLONIDINE HYDROCHLORIDE—see DRUG THERAPY
THERAPY
CLUSTER ANALYSIS—see EVALUATION
COAGULATION—see BLOOD
COGNITION
Development and Application of New Testing Procedures to the Study of Captions an 334
Development of Standards and Principles for Visual Displays for Deaf Persons. The Visu 330
Development of Stimulus Material for Research and Teaching Apparatus 244
Diagnosis and Remediation of Deficits in Visual Information Processing and Verbal 035
Differential Appreciation of Color and Form by Young Children 246
Functional, Social and Vocational Assessment of Surviving Persons with Documented 174
Hypoxia and Cognitive Functions in Cardiovascular and Obstructive Pulmonary Diseas 235
Oddity Discrimination in Young Children 245
Remediation of Untreated Impairments 006
Study of the Development and Change of Attitudes of Medical Students Throughout the 040
Technology Assessment: Human Rehabilitation Techniques 403
COLLAGEN/COLLAGEN DISEASE—see BIOCHEMISTRY
COLD THERAPY—see also PHYSICAL THERAPY
THERAPY
Effects of Specific Cutaneous Cold Stimulation on Motor Control in Cat and Man 150
COLLEGE PROGRAM
Project to Document the Development of a Cooperative Group Residence for Severel 184
COLOR-FORM DISCRIMINATION—see PERCEPTION
COMMUNICATION
Black Language Studies 175
Establishment of Normal Standards of the Spokes Test 172
Computer Aided Motor Communication for the Severely Disabled Non-Verbal 182
Crisis Intervention Rehabilitation Applied Research Program for the Severely Developm 258
Determining the Feasibility of a National Cooperative for the Development and Distrib 336
Development of a Model Demonstration Rehabilitation Service 203
Development of a Model for Evaluating the Relationship Between EMR Work/Study Pro 317
Development of Standards and Principles for Visual Displays for Deaf Persons. The Visu 330
Development of Videotapes for Application in Training Rehabilitation Counselors to W 344
Electronically Aided Communication for the Severely Physically Disabled Non-Verbal 178
Evaluation of Retarded Student Achievement in Career Education Programs 329
Free Speech Language Analysis 239
Functional, Social and Vocational Assessment of Surviving Persons with Documented 174
Learning Strategies of Deaf and Hearing Adults 339
Measuring Client Gain in Group Homes for the Retarded 321
Modification of Nasality in Utterances of Deaf Speakers 360
National Interpreter Training Consortium 345
Prognosis in Recovery from Aphasia 228
Serving Deaf Rehabilitation Clients Fundamentals of 273
Sociological Look at the Impact of Normalization 328
State Rehabilitation Agency as a System Serving Community Hospital Patients 351
Study of the Development and Change of Attitudes of Medical 040
Supervision in Vocational Rehabilitation 326
Telecommunications in Training of 415
Voice Activated Transducer for Severely Physically Disabled 188
COMMUNITY
Community-Based Growth Group for Disabled Persons 044
Community Group Homes for the Developmentally Disabled 318
Community Hospital as a System 347

Cost Analysis and Program Budgeting of Community Residential Facilities and 320
Crisis Intervention Rehabilitation Applied Research Program for the Severely 258
Effective Training in Rehabilitation Medicine in New Medical School Curricula 113
Effects of Special Olympics Participation on Retarded Children, Families, and 401
Evaluation of Retarded Student Achievement in Career Education Programs 329
Exercise Prescription in the Hospital 350
Factors Underlying Successful Adjustment of the Retarded Released from 400
Black Language Studies 175
Identification of Patients who Need Rehabilitation Services 348
Program for the Analysis of Deinstitutionalization Resources 319
Project Access 215
Project to Document the Development of a Cooperative Group Residence for Seve 184
Quality Assurance in Rehabilitation 349
Research Needs in Vocational Rehabilitation 327
Sociological Look at the Impact of Normalization 328
COMMUNITY HOSPITAL – see COMMUNITY
EXTENDED HEALTH FACILITY
COMMUNITY SERVICE SYSTEMS DEVELOPMENT – see COMMUNITY
SERVICE DELIVERY
COMPETENCIES – see BEHAVIOR
COMPETENCY-BASED INSTRUCTION – see EDUCATION
TRAINING
COMPUTER
Analysis of Information Processing Training for the Severely Disabled 143
Brown University-VR-CHIP-RT-7 Program 189
Clinical Application of Computer Scoring System of Electrocardiograms 226
Computer Characterization of Patient Services 204
Computer Retrieval of Data for Long Range Evaluation Studies of Medical 180
Computer Aided Motor Communication for the Severely Disabled Non-Verbal 182
Explore Means of Utilizing the Severely Disabled Homebound to Pool Rehabilitation 209
Job Development and Enhanced Productivity for Severely Disabled 218
Program Evaluation – Modular Information System to Evaluate Rehabilitation 310
Rehabilitation Information System (REHABIS) 384
Study of Cortical Organization Using Visual and Somatosensory Evoked Potentials 217
Systematic Analysis of Rehabilitation Data for Program Evaluation 308

CONDITIONING PROGRAM – see PHYSICAL THERAPY
CONGENITAL – see BIRTH DEFECT
CONGESTIVE HEART FAILURE – see CARDIAC DISORDER
CONGRUENCE – see also FAMILY
SIGNIFICANT OTHER
Family Unit as an Untapped Rehabilitation Force 306
CONNECTIVE TISSUE
Value of LDH Isoenzyme Studies in Collagen Disease 064
CONSUMER EDUCATION – see also EDUCATION
National Interpreter Training Consortium 345
CONSUMER GROUP
Consumer Advocacy Project 171
Consumer Involvement and Policy Development Consultation: A Resource Manual for 294
Effective Training in Rehabilitation Medicine in New Medical School Curricula 113
Deaf Community Development 333
National Interpreter Training Consortium 345
Project to Document the Development of a Cooperative Group Residence for Severely 184
CONSUMER INVOLVEMENT – see CONSUMER GROUP and CONSUMERS
CONSUMERS
Consumer Advocacy Project 171
Deaf Community Development 333

  Development of a Model for Evaluating the Relationship Between EMR Work Study Pro 317
  Home Management Education for the Mentally Retarded 255
  National Interpreter Training Consortium 345
  Study of Consumer Needs, Circumstances, and Attitudes 406
CONTINGENCY MANAGEMENT
  Contingency Management Systems in Medical Rehabilitation 080
  Follow-up Study of Patients Treated in the Pain Treatment Program: Physical Medicine 062
  Predicting Rate of Acquisition and Production of Complex Industrial Tasks by Institution 322
  Statistical Collection System for a Medical Rehabilitation Facility 181
  Supervision in Vocational Rehabilitation 326
CONTRACTURE
  Evaluation of Advanced Designs of Microwave Diathermy Applicators 068
  Further Studies of the Patho-Physiology of Spasticity 192
  Mechanism and Treatment of Muscle Contracture in Disabling Diseases 100
CONTROL – see MOTOR CONTROL
CONVULSION
  Technology Assessment: Human Rehabilitation Techniques 403
COOPERATION COMPETITION SKILLS – see BEHAVIOR SKILL
COORDINATION – see also MOTOR CONTROL
  Training Program for Upper Extremity Activities in Athetoid Patients 049
COPD – see CHRONIC OBSTRUCTIVE PULMONARY DISEASE
COR PULMONALE – see CARDIAC DISORDER
  RESPIRATORY DISORDER
CORONARY INSUFFICIENCY – see CARDIAC DISORDER
CORONARY REHABILITATION – see CARDIAC REHABILITATION
CORONARY RISK – see CARDIAC DISORDER
COST-EFFECTIVENESS
  Brown University-VR-CHIP-RT-7 Program 189
  Computer Retrieval of Data for Long Range Evaluation Studies of Medical Rehabilitat 180
  Development of a Systematic Problem Solving Approach to the Practice of Rehabilita 042
  Feedback Systems for Insuring Quality in Facility Based Services 411
  Follow-up Study of Rehabilitation Short-Term Training 325
  Job Development and Enhanced Productivity for Severely Disabled 218
  Rehabilitation Information System (REHABIS) 384
  Rehabilitation Policy Studies Part II Quality Assurance 039
  Statistical Collection System for a Medical Rehabilitation Facility 181
  Survey of Comprehensive Medical Rehabilitation Centers Serving the Most Severely 378
  Systems Analysis of the Delivery of Rehabilitation Services in a Rural Setting 229
COUNSELING
  Application of Personal Achievement Skills to Personal Adjustment Training for the 292
  Assessing Vocational Aptitudes Using a Task Performance Rating Scale 407
  Atlas of Vocational Histories of Persons with Spinal Cord Injuries 054
  Cluster Analysis of Personality Characteristics of Rehabilitation Clients 281
  Comparison of Differential Modeling Strategies in Counselor Training 277
  Comprehensive Evaluation of the Relationship Between Disability and Personality Func 289
  Contributions of Personal Achievement Skills to Work Adjustment Training 279
  Counselor Psychological Change Following In-Service Training and Client Contact 265
  Development and Evaluation of a Self-Instructional Physical Fitness Training Program for 293
  Development and Evaluation of a Set of Systematic Training Units to Increase or Decre 298
  Development and Evaluation of an Interpersonal Skills Training Package 288
  Development of an Improved System for Measuring Client Outcome 290
  Development of a Training Manual on Psychological Aspects of Disability 287
  Development of Videotapes for Application in Training Rehabilitation Counselors to W 344
  Evaluation of a Physical, Intellectual, and Emotional Personal Adjustment Training Prog 275
  Evaluation of the RIDAC (Rehabilitation Initial Diagnosis and Assessment for Clients) Proje 291
  Facilitative Case Management in Rehabilitation 271
  Factors Influencing Vocational Rehabilitation Counselor Utilization of Vocational Evalu 408

Follow-Along Study of Clients Returned for Service to a State Rehabilitation Agency 170
Handbook of Behavior Management: Procedures for Psychosocial Problems in Rehabilitation 260
Live Adjustment Post Myocardial Infarction Defining Predictive Variables 213
Longitudinal Study of the Social, Vocational, Legal and Family Status of Young Adult 259
Measure of Suitability of Placement 280
Model Casefinding, Counseling, and Referral Program For Deaf People 332
Pattern-Probability Model for Predicting Client Outcome 270
Process and Outcome in Cooperative School Programs in Texas 404
Rehabilitation Counseling: Development and Evaluation of a Comprehensive Counsel 299
Research on the Psychosocial and Vocational Adjustment of Spinal Cord Injured Clie 285
Serving Deaf Rehabilitation Clients: Fundamentals of Communication 273
Sexual Function in Physical Disability 041
State Agency Rehabilitation Counselor Functions and the Mentally Retarded 405
Study of Emotional Forces in Psychogenic Asthma 216
Study of the Development and Change of Attitudes of Medical Students Throughout the 040
Summary of the Results of Rehabilitation Counseling Research: 1955-1974 276
Systematic Psychosocial Vocational Treatment Strategies in Vocational Rehabilitation 300
Technology Assessment: Human Rehabilitation Techniques 403
Measure of Suitability of Placement 280
COUNSELOR TRAINING – see also COUNSELOR
Counselor Psychological Change Following In-Service Training and Client Contact 265
COXA VALGA – see HIP
CPS – see PROBLEM SOLVING
CREATINE – see ENERGY COMPOUND
CREATIVE PROBLEM SOLVING – see PROBLEM SOLVING
CRITICAL TASK
Comparative Clinical Evaluation of Several EMG Processing Techniques 164
CRUTCH – see also REHABILITATION DEVICE
Evaluation of Methods and Aids Used in Gait Training 073
CULTURAL-FAMILIAL ADJUSTMENT
Berko Morphology 241
Bibliography of Language Acquisition and Black Dialect 248
Free Speech Language Analysis 239
Grammatical Comprehension Test 237
Group Homes for the Mentally Retarded in the Rehabilitation Process 398
Information Transmission in the Mother-Child Dyad 242
ITPA Testing of Milwaukee Children 240
Overcoming Disincentives to the Rehabilitation of SSI and SSDI Beneficiaries 367
Personal-Social Functioning of Cooperative Work/Study Students: Parents' Perspective 394
Study of the Development and Change of Attitudes of Medical Students Throughout t 040
Use of Sentence Repetition Test II in Evaluating Language Acquisition in Populations 250
Use of a Sentence Repetition Test in Evaluating the Differential Acquisition of Langua 236
CURRICULUM DEVELOPMENT
Effective Training in Rehabilitation Medicine in New Medical School Curricula 358
Effective Training in Rehabilitation Medicine in New Medical School Curricula 185
Evaluation of Halfway House Training Programs for the Mentally Retarded 390
Home Management Education for the Mentally Retarded 255
Oddity Discrimination in Young Children 245
Opening Science Careers to the Handicapped 212
Personal-Social Functioning of Cooperative Work/Study Students: Parents' Perspectives 394
Study of the Development and Change of Attitudes of Medical Students Throughout th 040
Training Evaluation Kit 323
CYBERNETICS
Quantitative Studies of Muscular Strength and Muscular Work 050
CYBEX – see CYBERNETICS
CYCLIC AMP TREATMENT – see ENERGY COMPOUND THERAPY

- CYSTOMETRY
  - Electromyographic and Cystometrographic Study of Human Bladder 382
  - Studies of Urologic Function in Patients Following Spinal Cord Injuries 045

D

- DANTROLINE SODIUM – see ANTISPASTICITY DRUG
  - DRUG THERAPY
  - SPASTICITY
  - THERAPY
- DATA COLLECTION
  - Brown University-VR-CHIP-RT-7 Program 189
  - Client, Family, School and Community Variables Related to the Educational-Rehabilit 254
  - Collection and Analysis of Clinical Data on Scoliotic Patients 121
  - Computer Retrieval of Data for Long Range Evaluation Studies of Medical Rehabilitat 180
  - Conceptual Model of Planning and Evaluation of Rehabilitation Services 383
  - Consumer Advocacy Project 171
  - Content Analysis of Registered Nurses' Recordings Before and After Implementation of 086
  - Crisis Intervention Rehabilitation Applied Research Program for the Severely Developm 258
  - Differential Treatment of Functional Disabilities in Work Adjustment Programming 413
  - Effects of Vocational Evaluation on Client Vocational Awareness, Attitude and Comp 414
  - Exercise Prescription in the Hospital 350
  - Explore Means of Utilizing the Severely Disabled Homebound to Pool Rehabilitation Se 209
  - Factors Underlying Successful Adjustment of the Retarded Released from Institutions 400
  - Feedback Systems for Insuring Quality in Facility Based Services 411
  - Functional, Social and Vocational Assessment of Surviving Persons with Documented 174
  - Home Management Education for the Mentally Retarded 255
  - Identification of Patients who Need Rehabilitation Services 348
  - Investigation of the Mentally Retarded Clients Both Rehabilitated and Nonrehabilitate 256
  - Multimedia Rehabilitation Resource Center Project 210
  - Oddity Discrimination in Young Children 245
  - Program Evaluation – Modular Information System to Evaluate Rehabilitation 310
  - Rehabilitation Indicators: A Method for Enhancing Accountability 112
  - Rehabilitation Information System (REHABIS) 384
  - Rehabilitation Training Materials Study 211
  - Research Needs in Vocational Rehabilitation 327
  - Sociological Look at the Impact of Normalization 328
  - Statistical Collection System for a Medical Rehabilitation Facility 181
  - Studies of Urologic Function in Patients Following Spinal Cord Injuries 045
  - Supervision in Vocational Rehabilitation 326
  - Training Evaluation Kit 323
- DATA RETRIEVAL SYSTEM – see INFORMATION ACTIVITY
- DATA SYSTEM – see INFORMATION ACTIVITY
- DAY CARE
  - Crisis Intervention Rehabilitation Applied Research Program for the Severely Developm 258
  - Technology Assessment: Human Rehabilitation Techniques 403
- DEAF
  - Assessment of the Social Service Needs of Deaf People in Connecticut 338
  - Continuing Assessment of Programs for Preparation of Professionals to Work with Deaf 331
  - Cost Analysis of the Rehabilitation of Severely Disabled Deaf Clients 346
  - Deaf Community Development 333
  - Development and Application of New Testing Procedures to the Study of Captions an 334
  - Development of Standards and Principles for Visual Displays for Deaf Persons. The Vis 330
  - Development of Videotapes for Application in Training Rehabilitation Counselors to W 344
  - Identification of Deaf-Blind Individuals and the Development of Education & Rehabilit 392
  - Implementation of the Model State Plan for Vocational Rehabilitation of Deaf Clients 337
  - Learning Strategies of Deaf and Hearing Adults 339
  - Linguaplatal Cues as an Aid to Consonant Articulation in Deaf Adults 373

Model Casefinding, Counseling and Referral Program for Deaf People 332
Model State Plan Inventory 341
Modification of Nasality in Utterances of Deaf Speakers 360
National Interpreter Training Consortium 345
Overcoming Barriers to Deaf Persons in Federal Government 343
Preparation of a Training Manual Psychology of Deafness 267
Service Delivery Model for Deaf Inner City Residents 342
Serving Deaf Rehabilitation Clients: Fundamentals of Communication 273
Supplemental Security Income and the Deaf Community 335
Technology Assessment: Human Rehabilitation Techniques 403
Variables Related to the Attainment of Occupational Status Among Deaf Adults 340
DEAF-BLIND
Identification of Deaf/Blind Individuals and the Development of Education & Rehabili 392
Linguaplatal Cues as an Aid to Consonant Articulation in Deaf Adults 373
Technology Assessment: Human Rehabilitation Techniques 403
DECUBITUS ULCER – see PRESSURE SORE
SKIN DISORDER
ULCER
DEMOGRAPHIC FACTOR
Client, Family, School and Community Variables Related to the Educational/Rehabilit 254
Community Group Homes For the Developmentally Disabled 318
Cost Analysis and Program Budgeting of Community Residential Facilities and Rehabi 320
Functional, Social and Vocational Assessment of Surviving Persons with Documented 174
Personal-Social Functioning of Cooperative Work/Study Students: Parents' Perspectives 394
Rehabilitation Information System (REHABIS) 384
Technology Assessment: Human Rehabilitation Techniques 403
Variables Related to the Attainment of Occupational Status Among Deaf Adults 340
DENERVATION – see NERVE STUDY
DEPRESSION – see EMOTION
DERMATOMYOSITIS – see SKIN DISORDER
DEVELOPMENT
Analysis of Longitudinally Derived Data by a Programmed Statistical Package 247
Development of Stimulus Material for Research and Teaching Apparatus 244
Differential Appreciation of Color and Form by Young Children 246
Establishment of the High-Risk Population Laboratory 257
Extending Rehabilitation Services to the Multiply Handicapped 402
Follow-Along Study of Clients Returned for Service to a State Rehabilitation Agency 170
Information Transmission in the Mother-Child Dyad 242
Job Development and Enhanced Productivity for Severely Disabled 218
National System for Job Development in Micrographics 207
Word Association Among Low SES Children 251
DEVELOPMENT DISABILITY
Analysis of Public Assistance Social Services for the Mentally Retarded 324
Continuing Assessment of Programs for Preparation of Professionals to Work with Deaf 331
Crisis Intervention Rehabilitation Applied Research Program for the Severely Developm 258
Developing an Empirically Based Training Program in Mental Retardation 397
Extending Rehabilitation Services to the Multiply Handicapped 402
Health Services for Developmentally Disabled Adults 376
Investigation of the Mentally Retarded Clients both Rehabilitated and Nonrehabilitate 256
Longitudinal Study of the Social, Vocational, Legal and Family Status of Young Adult 259
Program for the Analysis of Deinstitutionalization Resources 319
Research Needs in Vocational Rehabilitation 327
Spinal Muscular Tone of Scoliosis Patients in Siblings 151
Technology Assessment: Human Rehabilitation Techniques 403
DEXTERITY
Crisis Intervention Rehabilitation Applied Research Program for the Severely Develop 258
Development of a General Purpose Vocational Assessment Technique 388

Effects of Special Olympics Participation on Retarded Children, Families, and Commu 401
Engineering Analysis and Evaluation of a New Radial Palsy Splint 169
Extending Rehabilitation Services to the Multiply Handicapped 402
Functional Achievement Evaluation RIC Tenodesis Splint 375
Technology Assessment: Human Rehabilitation Techniques 403

DIABETES
Evaluation of a Sonic Urinimeter for Blind Diabetics 149
Functional, Social and Vocational Assessment of Surviving Persons with Documented 174
Technology Assessment: Human Rehabilitation Techniques 403

DIAGNOSIS
Dysfunctions of Endocrine Glands in Spinal Cord Injury 027
Assessing Vocational Aptitudes Using a Task Performance Rating Scale 407
Automated Nerve Conduction Velocity Device 109
Comparison of Subjective Feelings of Pain with Impressions Obtained by Professional 094
Development of an Optimal Discriminant Function for the Early Detection of Scoliosis 141
Diagnosis and Remediation of Deficits in Visual Information Processing and 035
Evaluation of the RIDAC (Rehabilitation Initial Diagnosis and Assessment for Clients) Pr 291
Evaluation and Treatment of the Syndrome of Acute Arm Weakness: Multiple Distal Ne 077
Medical Information System as a Communication Link the State Agency Medical Rec 353
Nerve Conduction Studies as a Method of Differential Diagnosis of Neuropathies 187
Rehabilitation of Partial Peripheral Nerve Injuries in the Severely Disabled 071
Rehabilitation Policy Studies Part II: Quality Assurance 039
Spinal Muscular Tone of Scoliosis Patients in Siblings 151
Study of Artifacts of Electrodiagnostic Testing in Severe Neurological Disabilities 083
Study of Cortical Organization Using Visual and Somatosensory Evoked Potentials 217
Use of Motor Unit Potentials as a Measure of Neuromuscular Integrity 162

DIALYSIS
Clinical Component: Medical Complications of Patients with End Stage Renal Disease 223
Survey of the Rehabilitation and Employment Problems of Hemodialysis Patients 231
Technology Assessment: Human Rehabilitation Techniques 403

DIATHERMY – see THERAPY
DIETHYSTILBESTEROL – see HORMONE

DIGESTIVE SYSTEM
Technology Assessment: Human Rehabilitation Techniques 403

DIGITALIS – see CARDIAC DISORDER
DRUG THERAPY

DISABILITY DETERMINATION
Comparative Clinical Evaluation of Several EMG Processing Techniques 164
Functional, Social and Vocational Assessment of Surviving Persons with Documented 174
Establishment of Normal Standards of the Spokes Test 172
Factors Influencing Counselors Determination of Client Elgibility and Referral for Facility 417
Factors Influencing Vocational Rehabilitation Counselor Utilization of Vocational Evalu 408
Lateral Postural Control and Locomotor Performance in Normal Subjects and Patients 194
Longitudinal Study of the Social, Vocational, Legal and Family Status of Young Adult 259
Medical Examinations of a Selected Sample from the Study of Highland Heights, a Me 186
Overcoming Disincentives to the Rehabilitation of SSI and SSDI Beneficiaries 367
Re-Evaluation of Sensory Testing in Neurological Patients 163
Spinal Muscular Tone of Scoliosis Patients in Siblings 151

DISABILITY PREVENTION – see PREVENTIVE THERAPY

DISABLED
Analyzing Performance Competencies of Severely Handicapped Clients 314
Assessing Vocational Aptitudes Using a Task Performance Rating Scale 407
Community-Based Growth Group for Disabled Persons 044
Comprehensive Evaluation of the Relationship Between Disability and Personality Func 289
Continuing Assessment of Programs for Preparation of Professionals to Work with Deaf 331
Cost Analysis of the Rehabilitation of Severely Disabled Deaf Clients 346
Computer Aided Motor Communication for the Severely Disabled Non-Verbal 182

  - Deaf Community Development 333
  - Development of a Valid Multiple-Factor Instrument to Assess Severity of Handicap 316
  - Electronically Aided Communication for the Severely Physically Disabled Non-Verbal 178
  - Evaluation of the Feasibility of a Twelve Week Physiologically Paced Conditioning Pro 183
  - Functional, Social and Vocational Assessment of Surviving Persons with Documented 174
  - Effects of Vocational Evaluation on Vocational Rehabilitation 309
  - Energy Expenditures While Performing Normal Street Walking – A Comprehensive Stud 366
  - Engineering Analysis and Evaluation of a New Radial Palsy Splint 169
  - Explore Means of Utilizing the Severely Disabled Homebound to Pool Rehabilitation 209
  - Health Services for Developmentally Disabled Adults 376
  - Incorporation of a Lexan Check Socket into a Definitive Patellar Tendon Bearing Prost 114
  - Investigation of the Mentally Retarded Clients both Rehabilitated and Nonrehabilitate 256
  - Job Development and Enhanced Productivity for Severely Disabled 218
  - Medical Examinations of a Selected Sample From the Study of Highland Heights, a M 186
  - Model State Plan Inventory 341
  - National System for Job Development in Micrographics 207
  - Overcoming Barriers to Deaf Persons in Federal Government 343
  - Overcoming Disincentives to the Rehabilitation of SSI and SSDI Beneficiaries 367
  - Quantitative Studies of Muscular Strength and Muscular Work 050
  - Rehabilitation Follow-up Program 380
  - Scientific and Clinical Testing of New Experimental Drugs 161
  - Sexual Function in Physical Disability 041
  - Sociological Look at the Impact of Normalization 328
  - Severe Physical Disabilities of Unknown Etiology 098
  - Studies of Urologic Function in Patients Following Spinal Cord Injuries 045
  - Study of Artifacts of Electrodiagnostic Testing in Severe Neurological Disabilities 083
  - Supplemental Security Income and the Deaf Community 335
  - Survey of Comprenensive Medical Rehabilitation Centers Serving the Most Severely 378
  - Systematic Psychosocial Vocational Treatment Strategies in Vocational Rehabilitation 300
  - Technology Assessment: Human Rehabilitation Techniques 403
  - Towards a Placement System Empirically Established Through Criterion-Group Method: 312
  - Vocational Follow-up of the Physically Restored Unemployed 387
  - Voice Activated Transducer for Severely Physically Disabled 188
  - R-300: A Vocational Rehabilitation Profile (A Model for Assessing how Vocational 307
- DISADVANTAGED
  - Analysis of Longitudinally Derived Data by a Programmed Statistical Package 247
  - Development of Stimulus Material for Research and Teaching Apparatus 244
  - Differential Appreciation of Color and Form by Young Children 246
  - Establishment of the High-Risk Population Laboratory 257
  - Information Transmission in the Mother-Child Dyad 242
  - Longitudinal Study of the Social, Vocational, Legal and Family Status of Young Adult 259
  - Model Case Finding, Counseling and Referral Program for 332
  - Oddity Discrimination in Young Children 245
  - Overcoming Disincentives to the Rehabilitation of SSI and SSDI Beneficiaries 367
  - Service Delivery Model for Deaf Inner City Residents 342
  - Sociological Look at the Impact of Normalization 328
  - Standardization of a Technique to Facilitate Indexing Differential Development in Pre- 243
  - Supplemental Security Income and the Deaf Community 335
  - Use of a Sentence Repetition Test in Evaluating the Differential Acquisition of Languag 236
  - Word Association Among Low SES Children 251
- DISCRIMINATION – see PERCEPTION
- DISINCENTIVES
  - Negative Incentives: Contingencies Which Discourage Disabled Individuals from See 315
  - Overcoming Disincentives to the Rehabilitation of SSI and SSDI Beneficiaries 367
- DISODIUM ETIDRONATE – see DRUG THERAPY, MINERAL
- DISTRICT OFFICES
  - State Rehabilitation Agency as a System Serving Community Hospital Patients 351

Survey of the Subsystems in the State Rehabilitation Agency District Office 352
DRIVER TRAINING – see also MOBILITY LIMITED
TRANSPORTATION
Assessment of Driving Capabilities of the Brain Injured Population 206
Method for Enhancing Accountability 031
DRUG ABUSE
Review and Analysis of Drug Treatment Literature 268
DRUG ADDICTION – see DRUG ABUSE
DRUG EFFECTS – see DRUG ABUSE
DRUG THERAPY
Review and Analysis of Drug Treatment Literature 268
Scientific and Clinical Testing of New Experimentel Drugs 161
Studies of Urologic Function in Patients Following Spinal Cord Injuries 045
Technology Assessment: Human Rehabilitation Techniques 403
DRUG THERAPY
Review and Analysis of Drug Treatment Literature 268
Scientific and Clinical Testing of New Experimental Drugs 161
Studies of Urologic Function in Patients Following Spinal Cord Injuries 045
Technology Assessment: Human Rehabilitation Techniques 403
DUCHENE MUSCULAR DYSTROPHY – see DYSTROPHY
DYSARTHERIA – see SPEECH DISORDER
DYSPLASIA – see DEVELOPMENT
DYSPNEA – see RESPIRATORY DISORDER
DYSTROPHY
Controlled Assessment of the Effect of Submaximal Exercise in Muscular Dystrophy 070
Role of Feedback in Control of Motor Function 198
Hormonal Agents in Myopathy 152
Modification of Speech Patterns of Normal and Dysarthric Speakers as a Function of 116
Use of Motor Unit Potentials as a Measure of Neuromuscular Integrity 162

E
EAR – see HEARING
EGG – see HEART
ECHOGRAPHY
Echocardiographic Assessment of Ventricular Motion During Exercise 234
ECTOPIC BONE FORMATION – see BONE MINERAL
EDUCABLE MENTALLY RETARDED – see MENTALLY RETARDED
EDUCATION – see also TEACHING
TRAINING
Adult Basic Education for the Mentally Retarded 253
Crisis Intervention Rehabilitation Applied Research Program for the Severely Developm 258
Development of a Competency-Based Staff Development Program for Vocational Eva 416
Development of a Model for Evaluating the Relationship Between EMR Work/Study Pro 317
Development of Stimulus Material for Research and Teaching Apparatus 244
Development of Videotapes for Application in Training Rehabilitation Counselors to W 344
Explore Means of Utilizing the Severely Disabled Homebound to Pool Rehabilitation Ser 209
Factors Underlying Successful Adjustment of the Retarded Released From Institutions 400
Functional, Social and Vocational Assessment of Surviving Persons With Documented 174
Learning Strategies of Deaf and Hearing Adults 339
National System for Job Development in Micrographics 207
Oddity Discrimination in Young Children 245
Personal-Social Functioning of Cooperative Work/Study Students: Parents' Perspectives 394
Preliminary Investigation of Micrographic Viewer for use by Disabled Persons 371
Process and Outcome in Cooperative School Programs in Texas 404
Study of the Development and Change of Attitudes of Medical Students Throughout th 040
Technology Assessment: Human Rehabilitation Techniques 403
Telecommunications in Training of Rehabilitation Facility Personnel 415
Training Evaluation Kit 323
EEG – see BRAIN

EKG – see CARDIAC
ELBOW – see EXTREMITY
        JOINT
ELDERLY – see AGED
ELECTRICAL ASSISTIVE DEVICE – see REHABILITATION DEVICE
ELECTRICAL STIMULATION – see STIMULATION
ELECTROCARDIOGRAPH – see HEART
ELECTROCAUTERY – see THERAPY
ELECTRODIAGNOSIS – see also DIAGNOSIS
    Automated Nerve Conduction Velocity Device 109
    Comparison of Subjective Feelings of Pain with Impressions Obtained by Professional 094
    Evaluation and Treatment of the Syndrome of Acute Arm Weakness: Multiple Distal Ne 077
    Rehabilitation of Partial Peripheral Nerve Injuries in the Severely Disabled 071
    Study of Artifacts of Electrodiagnostic Testing in Severe Neurological Disabilities 083
ELECTROLYTE – see BIOCHEMICAL
ELECTROMAGNETIC ENERGY – see RADIATION
ELECTROMAGNETIC RADIATION – see RADIATION
ELECTROMYOGRAPHY – see MUSCLE STUDY
ELECTRONIC DEVICE – see REHABILITATION DEVICE
ELECTRONIC EQUIPMENT – see EQUIPMENT
        REHABILITATION DEVICE
ELECTRONYSTAGMOGRAPHY – see NYSTAGMUS
ELECTRO-OCCULOGRAPHY – see DIAGNOSIS
ELECTROPHYSIOLOGY – see PHYSIOLOGY
ELECTROSURGERY – see SURGERY
ELIGIBILITY DETERMINATION – see CASE FINDINGS
        EVALUATION
EMG – see MUSCLE STUDY
EMOTION
    Comprehensive Evaluation of the Relationship Between Disability and Personality Func 289
    Effects of Different Types of Frustrating Conditions on the Behavior of Institutionalized 252
    Evaluation of a Physical, Intellectual, and Emotional Personal Adjustment Training Prog 275
    Longitudinal Study of Depressive Reactions in Persons with Spinal Cord Injuries 132
    Study of the Development and Change of Attitudes of Medical Students Throughout th 040
EMPATHY – see EMOTION
EMPHYSEMA – see RESPIRATORY DISORDER
EMPLOYABILITY – see EMPLOYMENT
        PLACEMENT
        WORK
EMPLOYMENT – see also PLACEMENT
        WORK
    Appropriate Entry Level Jobs and Sheltered Workshop Tasks for the Less Educated, Sev 147
    Atlas of Vocational Histories of Persons with Spinal Cord Injuries 054
    Crisis Intervention Rehabilitation Applied Research Program for the Severely Developm 258
    Development of a General Purpose Vocational Assessment Technique 388
    Evaluation of Retarded Student Achievement in Career Education Programs 329
    Explore Means of Utilizing the Severely Disabled Homebound to Pool Rehabilitation Ser 209
    Follow-Along Study of Clients Returned for Service to a State Rehabilitation Agency 170
    Functional, Social and Vocational Assessment of Surviving Persons with Documented C 174
    Job Development and Enhanced Productivity for Severely Disabled 218
    Longitudinal Study of the Social, Vocational, Legal and Family Status of Young Adult 259
    Measure of Suitability of Placement 280
    Measuring Client Gain in Group Homes for the Retarded 321
    National System for Job Development in Micrographics 207
    Overcoming Barriers to Deaf Persons in Federal Government 343
    Overcoming Disincentives to the Rehabilitation of SSI and SSDI Beneficiaries 367
    Predicting Rate of Acquisition and Production of Complex Industrial Tasks by Institution 322

  Process and Outcome in Cooperative School Programs in Texas 404
  Research Needs in Vocational Rehabilitation 327
  Sociological Look at the Impact of Normalization 328
  Supervision in Vocational Rehabilitation 326
  Survey of the Rehabilitation and Employment Problems of Hemodialysis Patients 231
  Technology Assessment: Human Rehabilitation Techniques 403
  Towards a Placement System Empirically Established Through Criterion-Group Method: 312
  Variables Related to the Attainment of Occupational Status Among Deaf Adults
  Vocational Follow-up of the Physically Restored Unemployed 387
  R-300: A Vocational Rehabilitation Profile (A Model for Assessing How Vocational 307
  Rehabilitation of the End-Stage Renal Disease Client – Selected Readings 295
  Energy Expenditures While Performing Normal Street Walking -- A Comprehensive Stu 366
END STAGE RENAL DISEASE
  Clinical Component: Medical Complications of Patients 223
  Rehabilitation of the End-Stage Renal Disease Client – Selected Readings
ENGINEERING – see BIOENGINEERING
ENTERIC INFECTION – see DIGESTIVE SYSTEM
  INFECTION
ENTEROBACTERIAL VACCINE – see PATHOGENIC BACTERIA
  VACCINE
ENVIRONMENT
  Effect of Environmental Factors and Geographic Location on Vocational Rehabilitatio 002
  Factors Underlying Successful Adjustment of the Retarded Released from Institutions 400
  Study of Consumer Needs, Circumstances, and Attitudes 406
  Technology Assessment: Human Rehabilitation Techniques 403
  Use of the Work Environment Scale to Describe a Rehabilitation Research and Trainin 274
ENVIRONMENTAL APPLIANCE – see REHABILITATION DEVICE
ENZYME
  Value of LDH Isoenzyme Studies in Collagen Disease 064
EOG – see DIAGNOSIS
EPINEPHRINE – see BIOGENIC AMINE
  HORMONE
EQUAL CAREER OPPORTUNITIES – see CAREER
  MINORITY GROUP
EQUILIBRIUM
  Postural Control in Neurosensory Disability: Functional Implications and Therapeutic 191
EQUIPMENT
  Clinical Field Trials of the Emory Detachable Electric Powered Drive for the Standard 160
  Computer Aided Motor Communication for the Severely Disabled Non-Verbal 182
  Crisis Intervention Rehabilitation Applied Research Program for the Severely Developm 258
  Development and Evaluation of Automatic Warning Device to Help Prevent Pressure U 359
  Development of a System for Determination of Frequency and Volume of Urination in 356
  Effect of Cervical Orthoses on Cervical Spine Motion: A Standardized Radiographic M 065
  Electronically Aided Communication for the Severely Physically Disabled Non-Verbal 178
  Energy Expenditures While Performing Normal Street Walking – A Comprehensive Stud 366
  Heliomagnestat Study No. 2 – Heliomagnestat (TM) in Pain States – Long-Term Study 148
  Heliomagnestat Study No. 3 – The Heliomagnestat (TM) in Pain: A Reinforcer in Contin 153
  Heliomagnestat Study No. 4 – The Heliomagnestat (TM) in Back Pain: A Bio-Engineerin 154
  Preliminary Investigation of Micrographic Viewer for Use by Disabled Persons 371
  Quantitative Studies of Muscular Strength and Muscular Work 050
  Technology Assessment: Human Rehabilitation Techniques 403
ESTROGEN – see HORMONE
ETHNIC GROUP – see MINORITY GROUP
EVALUATION
  Assessment and Evaluation of Home Health Team Activities 372
  Assessment of Driving Capabilities of the Brain Injured Population 206
  Assessing Vocational Aptitudes Using a Task Performance Rating Scale 407

Clinical Classification and Functional Prediction: A Study of the stroke Population	205
Brown University-VR-CHIP-RT-7 Program	189
Cluster Analysis of Personality Characteristics of Rehabilitation Clients	281
Comparative Clinical Evaluation of Several EMG Processing Techniques	164
Community-Based Maintenance Care for the Long-Term Patient (Planning Grant to De	166
Computer Retrieval of Data for Long Range Evaluation Studies of Medical Rehabilitati	180
Comprehensive Evaluation and Treadmill Exercise Testing in Treated Patients for Hypert	208
Comprehensive Evaluation of the Relationship Between Disability and Personality Funct	289
Computer Characterization of Patient Services	204
Content Analysis of Registered Nurses' Recordings Before and After Implementation of	086
Continuing Assessment of Programs for Preparation of Professionals to Work with Deaf P	331
Crisis Intervention Rehabilitation Applied Research Program for the Severely Developm	258
Day Care Pulmonary Rehabilitation Program Evaluation	381
Developing a Model for the Analysis of Case Movement in a Vocational Rehabilitation	297
Development and Evaluation of a Systematic Physical Fitness Training Program for	278
Development and Evaluation of a Training Package in Program Evaluation	296
Development and Evaluation of an Interpersonal Skills Training Package	288
Development of a General Purpose Vocational Assessment Technique	388
Development of a Measurement Tool for Placements in Care Facilities	066
Development of a Model for Evaluating the Relationship Between EMR Work/Study Pr	317
Development of a Valid Multiple-Factor Instrument to Assess Severity of Handicap	316
Dimensions of Rehabilitation Outcome: A Factor Analystic Study of Several Measures	284
Effect of Cervical Orthoses on Cervical Spine Motion: A Standardized Radiographic M	065
Effects of Vocational Evaluation on Client Vocational Awareness, Attitude and Compe	414
Effects of Vocational Evaluation on Vocational Rehabilitation	309
Effects of Vocational Evaluation Programming on the Vocational Development of Rur	409
Employment Potential of the Severely Disabled Young Adult	157
Establishment of Normal Standards of the Spokes Test	172
Evaluation of an Automated Training System for Wheelchair Pushups	051
Evaluation of Exercise After Myocardial Infarction: National Exercise and Heart Diseas	155
Evaluation of the Feasibility of a Twelve Week Phyisiologically Paced Conditioning Pro	183
Evaluation of Halfway House Training Programs for the Mentally Retarded	390
Evaluation of Retarded Student Achievement in Career Education Programs	329
Evaluation of a Physical, Intellectual, and Emotional Personal Adjustment Training Prog	275
Evaluation of the RIDAC (Rehabilitation Initial Diagnosis and Assessment for Clients) Pr	291
Facilitative Case Management in Rehabilitation	271
Factors Influencing Counselors Determination of Client Eligibility and Referral for Facilit	417
Factors Influencing Vocational Rehabilitation Counselor Utilization of Vocational Evalu	408
Feedback Systems for Insuring Quality in Facility Based Services	411
Follow-Along Study of a Medically Disabled Population in Fall River, Massachusetts: A	179
Follow-up Study of Rehabilitation Short-Term Training	325
Functional Achievement Evaluation RIC Tenodesis Splint	375
Functional, Social and Vocational Assessment of Surviving Persons with Documented	174
Health Services for Developmentally Disabled Adults	376
Homogeneous Sub-Scales for the Mini-Mult	272
Identification of Factors Affecting Behavioral Competency in a Comprehensive Reha	302
Investigation of the Mentally Retarded Clients both Rehabilitated and Nonrehabilitate	256
Job Development and Enhanced Productivity for Severely Disabled	218
Longitudinal Analysis of Patient Behavior	139
Measuring Client Gain in Group Homes for the Retarded	321
Model State Plan Inventory	341
National System for Job Development in Micrographics	207
Predicting Rate of Acquisition and Production of Complex Industrial Tasks by Institution	322
Prevention of Urinary Tract Infection in Spinal Cord Injury	385
Process and Outcome in Cooperative School Programs in Texas	404
Process and Out comes of Vocational Evaluation Services	412

  - Program Evaluation and Planning (Tools for Rehabilitation) 311
  - Program Evaluation Methods for State Vocational Rehabilitation Agencies 269
  - Program Evaluation – Modular Information System to Evaluate Rehabilitation 310
  - Program Evaluation Techniques in Vocational Rehabilitation Agencies and Facilities 301
  - Program for the Analysis of Deinstitutionalization Resources 319
  - Project to Provide Systematic Follow-Along to Persons Medically Rehabilitated in Fall 167
  - Quantification of the Biomechanical Function of Various Designs and Adjustments of 101
  - Quantitative and Qualitative Evaluation of Muscular Hypertonia in Patients with Centra 047
  - Quantitative Studies of Muscular Strength and Muscular Work 050
  - Rehabilitation Counseling: Development and Evaluation of a Comprehensive Counsel 299
  - Rehabilitation Needs of Cancer Patients 117
  - Rehabilitation Policy Studies Part II: Quality Assurance 039
  - Replication of Eber's Multivariate Analysis of a Vocational Rehabilitation System 266
  - Simplified Model for Cost-Benefit Analyis in Rehabilitation Programs 313
  - Study of the Development and Change of Attitudes of Medical Students Throughout t 040
  - Supervision in Vocational Rehabilitation 326
  - Survey of the Subsystems in the State Rehabilitation Agency District Office 352
  - Systematic Analysis of Rehabilitation Data for Program Evaluation 308
  - Training Evaluation Kit 323
  - Use of the Work Environment Scale to Describe a Rehabilitation Research and Training 274
  - R-300: A Vocational Rehabilitation Profile (A Model for Assessing How Vocational Reh 307
  - Work Tolerance Evaluation Research and Training Unit for a Cardiac Rehabilitation Pr 112
- EXERCISE – see PHYSICAL ACTIVITY
- EXERCISE STRESS TEST
  - Comprehensive Evaluation and Treadmill Exercise Testing in Treated Patients for Hype 208
  - Early Adjustment to Steady and Unsteady Exercise in Patients with Cardio-Pulmonary 232
  - Effects of Special Olympics Participation on Retarded Children, Families, and Comm 401
  - Physiologic Responses of Hemiparetic Patients to Specific Exercise Stress 168
  - Serial Investigation of Myocardial Infarction Patients Using Noninvasive Techniques 225
- EXERCISE THERAPY – see PHYSICAL THERAPY
- ENDOCRINE GLAND – see HORMONE
- EXTENDED HEALTH CARE FACILITY – see also HEALTH CARE
  - Community Hospital as a System 347
  - Exercise Prescription in the Hospital 350
  - Functional, Social and Vocational Assessment of Surviving Persons with Documented 174
  - Identification of Patients who Need Rehabilitation Services 348
  - Medical Examinations of a Selected Sample From the Study of Highland Heights, a M 186
  - Natural History of Deep-Vein Thrombosis in the Spinal Cord Injured 386
  - Quality Assurance in Rehabilitation 349
  - Technology Assessment: Human Rehabilitation Techniques 403
- EXTREMITY – see also HIP
  - Functional, Social and Vocational Assessment of Surviving Persons with Documented 174
  - Research in Upper and Lower Extremity Orthotics 177
  - Technology Assessment: Human Rehabilitation Techniques 403
  - Training Program for Upper Extremity Activities in Athetoid Patients 049
  - Quantification of the Biomechanical Function of Various Designs and Adjustments of 101
- EYE
  - Response Oriented Sensory Aid for Assessment and Treatment of Oculomotor Dysfunc 197
  - Visual System Disorders and Functional Correlates 200
  - Technology Assessment: Human Rehabilitation Techniques 403

F

- FACIAL DISORDER
  - Etiology, Prognosis, and Effects of Treatment in Bell's Palsy 165
- FACIAL NERVE LATENCY – see FACIAL DISORDER
  NERVE STUDY

FACIAL PALSY – see FACIAL DISORDER
PALSY
FACILITATIVE CASE MANAGEMENT – see CASE MANAGEMENT
FACILITY – see EXTENDED CARE FACILITY
HEALTH CARE
FACILITY EVALUATION – see EVALUATION
PROGRAM EVALUATION
FACTOR ANALYSIS – see EVALUATION
PROGRAM EVALUATION
REHABILITATION GOAL
FACTOR X
- Structure and Function of Factor X 012

FAMILY
- Community-Based Maintenance Care for the Long-Term Patient (Planing Grant to De 166
- Development of a Model for Evaluating the Relationship Between EMR Work/Study Pr 317
- Establishment of the High-Risk Population Laboratory 257
- Evaluation of Retarded Student Achievement in Career Education Programs 329
- Factors Underlying Successful Adjustment of the Retarded Released from Institutions 400
- Family Factors in the recurrence and Maintenance of Alcoholism and Other Chronic 214
- Functional, Social and Vocational Assessment of Surviving Persons with Documented 174
- Measuring Client Gain in Group Homes for the Retarded 321
- Role of Family in Institutional Rehabilitation of Clients with Behavioral and Physical Dis 220
- Use of Sentence Repetition Test II in Evaluating Language Acquisition in Populations w 250
- Variables Related to the Attainment of Occupational Status Among Deaf Adults 340

FATHER-see PARENT
FATIGUE
- Development of Standards and Principles for Visual Displays for Deaf Persons. The 330
- Quantitative Studies of Muscular Strength and Muscular Work 050

FEASIBILITY STUDY – see RESEARCH PROGRAM
FECAL INCONTINENCE – see ACTIVITY OF DAILY LIVING
BOWEL PROGRAM
FEDERAL GOVERNMENT
- Follow-Along Study of Clients Returned for Service to a State Rehabilitation Agency 170
- Investigation of the Mentally Retarded Clients Both Rehabilitated and Nonrehabilitated 256
- Multimedia Rehabilitation Resource Center Project 210
- Overcoming Barriers to Deaf Persons in Federal Government 343
- Rehabilitation Training Materials Study 211

FEEDBACK-see BIOFEEDBACK
FIBROMYOSITIS – see MUSCULAR DISORDER
FILM – see AUDIOVISUAL AID
FILM BIBLIOGBRAPHY – see BIBLIOGRAPHY
FINANCING
- Evaluation of the Relationship of Self-Care Outcomes to Care in the Acute Hospital, th 055
- Cost Analysis and Program Budgeting of Community Residential Facilities and Rehabi 320
- Negative Incentives: Contingencies which Discourage Disabled Individuals from Seeki 315
- Rehabilitation of the Rural Public Assistance Recipient at a Comprehensive Rehabilita 262
- Simplified Model for Cost-Benefit Analysis in Rehabilitation Programs 313
- Statistical Collection System for a Medical Rehabilitation Facility 181
- Study of Consumer Needs, Circumstances, and Attitudes 406

FINGER – see EXTREMITY
FINGER SPELLING
- Development and Application of New Testing Procedures to the Study of Captions an 334
- National Interpreter Training Consortium 345
- Technology Assessment: Human Rehabilitation Techniques 403

FLAT FEET – see EXTREMITY
FLOUROGRAPHY – see DIAGNOSIS

FOLLOW-ALONG STUDIES
  Computer Characterization of Patient Services 204
  Day Care Pulmonary Rehabilitation Program Evaluation 381
  Evaluation of the Feasibility of a Twelve Week Phyisiologically Paced Conditioning Pro 183
  Follow-Along Study of a Medically Disabled Population in Fall River, Massachusetts: A 179
  Project to Provide Systematic Follow-Along to Persons Medically Rehabilitated in Fall R 167
  Rehabilitation Information System (REHABIS) 384
  Studies of Urologic Function in Patients Following Spinal Cord Injuries 045

FOLLOW-UP STUDIES
  Factors Underlying Successful Adjustment of the Retarded Released from Institutions 400
  Follow-up Study of Patients Treated in the Pain Treatment Program: Physical Medicine 062
  Follow-up Study of Rehabilitation Short-Term Training 325
  Functional Achievement Evaluation RIC Tenodesis Splint 375
  Functional, Social and Vocational Assessment of Surviving Persons with Documented 174
  Group Homes for the Mentally Retarded in the Rehabilitation Process 398
  Rehabilitation Follow-up Program 380
  Studies of Urologic Function in Patients Following Spinal Cord Injuries 045
  Survey of Comprehensive Medical Rehabilitation Centers Serving the Most Severely 378
  Training Evaluation Kit 323
  Vocational Follow-up of the Physically Restored Unemployed 387
FOOT – see EXTREMITY
FOOT-ANKLE BRACE – see ORTHOSIS
  PROSTHESIS
FOOT-FLOOR REACTION – see EXTREMITY
FRACTURE – see BONE
FREUND'S ADJUVANT
  Project to Provide Systematic Follow-Along to Persons Medically Rehabilitated in Fall R 167
FRUSTRATION – see BEHAVIOR
  EMOTION
FUNCTIONAL ASSESSMENT – see EVALUATION
FUNCTIONAL DISABILITIES – see DISABILITY
FUNCTIONAL ELECTRICAL PERONEAL STIMULATION (FEPS) – see STIMULATION
FUNCTIONAL LIFE SCALE – see ACTIVITY OF DAILY LIVING
  RATING SCALE

G

GAIT – see AMBULATION
GUNINENESS – see EMOTION
GEOGRAPHICAL FACTOR – see ENVIRONMENT
GERIATRIC – see AGED
GHETTO – see MINORITY GROUP
  URBAN PROBLEM
GLOMUS – see CIRCULATION
GLOMERULONEPHRITIS – see RENAL FUNCTION
GLUCOSE – see BIOCHEMISTRY
GOLD TREATMENT – see THERAPY
GOLGI TENDON ORGAN – see MUSCLE STUDY
GRADED ACTIVITY – see PHYSICAL ACTIVITY
GRAMMATICAL COMPREHENSION – see LEARNING
GRANULEX SPRAY – see DRUG THERAPY
GRASP – see ACTIVITY OF DAILY LIVING
  SKILL
GRAVITY LOADING – see MUSCLE STUDY
  PHYSICAL ACTIVITY GROUP
  Behavioral Architecture Ecological Designing of Facilities for the Mentally Retarded 389
  Community-Based Growth Group for Disabled Persons 044

Sociological Look at the Impact of Normalization 328
Use of the Work Environment Scale to Describe a Rehabilitation Research and Training Ce 274
GROUP HOME
Community Group Homes for the Developmentally Disabled 318
Cost Analysis and Program Budgeting of Community Residential Facilities and Rehabilit 320
Factors Underlying Successful Adjustment of the Retarded Released from Institutions 400
Group Homes for the Mentally Retarded in the Rehabilitation Process 398
Measuring Client Gain in Group Homes for the Retarded 321
Project to Document the Development of a Cooperative Group Residence for Severely 184
Program for the Analysis of Deinstitutionalization Resources 319
Sociological Look at the Impact of Normalization 328
Technology Assessment: Human Rehabilitation Techniques 403
GROUP GROWTH – see GROUP
GROUP THERAPY – see THERAPY
GUIDANCE COUNSELING – see COUNSELING
GUILLAIN BARRE POLYNEURITIS – see NERVE DISORDER

H

HALFWAY HOUSES
Evaluation of Halfway House Training Programs For the Mentally Retarded 390
Factors Underlying Successful Adjustment of the Retarded Released From Institutions 400
Group Homes for the Mentally Retarded in the Rehabilitation 398
Project of Document the Development of a Cooperative Group Residence for Severely 184
Sociological Look at the Impact of Normalization 328
HAND-see EXTREMITY
HAND FUNCTION TEST
Functional Achievement Evaluation RIC Tenodesis Splint 375
Investigations of Validity and Clinical Use of Children's Hand Function Test 082
Re-evaluation of Sensory Testing in Neurological Patients 163
HANDBOOK
Cost Analysis and Program Budgeting of Community Residential Facilities and 320
Development of a Training Manual on Psychological Aspects of Disability 287
Development and Evaluation of a Training Package in Program Evaluation 296
Feedback Systems for Insuring Quality in Facility Based Services 411
Handbook of Behavior Management Procedures for Psychsocial Problems in Rehabilit 260
Multimedia Rehabilitation Resource Center Project 210
Rehabilitation Training Materials Study 211
Studies of Urologic Function in Patients Following Spinal Cord Injuries 045
Use of Self-Instructional Training Material with Rehabilitation Personnel 286
HANDICAPPED – see DISABLED
HEADACHE – see PAIN
HEAD-NECK GONIOMETER – see GONIOMETER
HEALTH AGENCY – see AGENCY
HEALTH CARE
Analysis of Public Assistance/Social Services for the Mentally-Retarded 324
Brown University-VR-CHIP-RT-7 Program 189
Community Hospital as a System 347
Functional, Social and Vocational Assessment of Surviving Persons with Documented 174
Health Services for Developmentally Disabled Adults 376
Rehabilitation Policy Studies Part II Quality Assurance 039
Survey of Comprehensive Medical Rehabilitation Centers Serving the Most Severely 378
Systems Analysis of the Delivery of Rehabilitation Services in a Rural Setting 229
Validity and Reliability of Health Accounting Method of Quality Assurance in a 059
HEALTH ACCOUNTING – see QUALITY ASSURANCE
HEALTH CARE DELIVERY – see HEALTH CARE AND
SERVICE DELIVERY

HEALTH CARE
  Brown University-VR-CHIP-RT-7 Program 189
  Conceptual Model of Planning and Evaluation of Rehabilitation Services 383
  Health Services for Developmentally Disabled Adults 376
HEALTH-CAREER-see CAREER
HEALTH PROFESSIONAL – see ALLIED HEALTH PERSONNEL
HEALTH SERVICE DELIVERY – see HEALTH CARE
  SERVICE DELIVERY
HEARING
  Continuing Assessment of Programs for Preparation of Professionals to Work with Deaf 331
  Linguaplatal Cues as an Aid to Consonant Articulation in Deaf Adults 373
  National Interpreter Training Consortium 345
  Vibrotactile Learning with Mentally Retarded Subjects 391
HEARING DISORDER – see HEARING
  DEAF
HEART – see also CARDIAC CONDITIONING
  CARDIAC DISORDER
  CARDIAC OUTPUT
  CARDIAC PERFORMANCE
  CARDIAC PROGRAM
  CARDIAC REHABILITATION
  CARDIAC TOLERANCE
  CARDIOVASCULAR-RESPIRATORY DISORDERS
  Effects of Special Olympics Participation on Retarded Children, Families, and Co 401
  Evaluation of Exercise after Myocardial Infarction National Exercise and Heart Disease 155
  Exercise and Lipid Profile in Ischemic Heart Disease 137
  Factors Influencing the Right Heart Failure of Patients with Chronic Pulmonary Disease 003
  Functional, Social and Vocational Assessment of Surviving Persons with Documented 174
  Portable Exercise Monitoring System for Patients with Coronary Artery Disease 063
  Study of Cardiac Work Evaluation and Reconditioning after Myocardial Infarction 046
  Field Testing of a Cardiac Evaluation Technique for Counselor Use in Vocational 230
  Work Tolerance Evaluation Research and Training Unit for a Cardiac Rehabilitation 122
HEART DISEASE – see CARDIAC DISORDER
HEART FAILURE – see CARDIAC DISORDER
HEMICHOREA – see SPASTICITY
HEMIPARESIS
  Evaluation of the Feasibility of a Twelve Week Phyisiologically Paced Conditioning 183
  Functional, Social and Vocational Assessment of Surviving Persons with Documented 174
  Multi-Electrode Studies of Patients with Spastic Central Nervous Disorders 199
  Physiologic Responses of Hemiparetic Patients to Specific Exercise Stress 168
HEMIPLEGIA
  Evaluation of the Relationship of Self-Care Outcomes to Care in the Acute Hospital 055
  Functional Skills Remediation in Hemiplegia Assessment Model for Eye-Hand Skills 005
  Functional, Social and Vocational Assessment of Surviving Persons with Documented 174
  Lateral Postural Control and Locomotor Peformance in Normal Subjects and Patients 194
  Motor Control and Its Relationship to Functional Activities 202
  Physiologic Responses of Hemiparetic Patients to Specific Exercise Stress 168
  Postural Control in Neurosensory Disability: Functional Implications and Therapeutic Man 191
  Postural Control in the Initiation of Gait: Normal and Pathological Mechanisms 196
  Quantification of the Biomechanical Function of Various Designs and Adjustments of 101
  Remediation of Untreated Impairments 006
  Use of Motor Unit Potentials as a Measure of Neuromuscular Integrity 162
HEMODIALYSIS – see also BLOOD
  Survey of the Rehabilitation and Employment Problems of Hemodialysis Patients 231
HETEROTOPIC BONE – see BONE DISORDER
HIGH – see GROWTH
  HORMONE

HIGH RISK POPULATION
  Analysis of Longitudinally Derived Data by a Programmed Statistical Package 247
  Development of Stimulus Material for Research and Teaching Apparatus 244
  Free Speech Language Analysis Functional, Social and Vocational Assessment of 239
  Functional, Social and Vocational Assessment of Surviving Persons with Documented 174
  Grammatical Comprehension Test 237
  Modified Sentence Repetition Test II 249
  Oddity Discrimination in Young Children 245
  Role of Family in Institutional Rehabilitation of Clients with Behavioral and Physical 220
  Standardization of a Technique to Facilitate Indexing Differential Development in 243
  Use of Sentence Repetition Test II in Evaluating Languge Acquisition in Populations wit 250
  Use of a Sentence Repetition Test in Evaluating the Differential Acquisition of Languag 236
HIGH SCHOOL
  Development of a Model for Evaluating the Relationship Between EMR Work 317
  Longitudinal Study of Quadriplegic Young Adults in a Cooperative Self-Support Resid 133
  Effects of Vocational Evaluation Programming on the Vocational Development of Rur 409
  Evaluation of Retarded Student Achievement in Career Education Programs 329
  Longitudinal Study of the Social, Vocational, Legal and Family Status of Young Adult 259
  Process and Outcome in Cooperative School Programs in Texas 404
HILL INTERACTION MATRIX – see RATING SCALE
HILL REACTION MATRIX – see RATING SCALE
HIP – see also JOINT
  Effects of Ultrasound on Bone Healing 067
  Homotransplantation of Total Hip Joint Articular Cartilage in Dogs 176
HOME – see also HOMEBOUND
  Assessment and Evaluation of Home Health Team Activities 372
  Black Language Studies 175
HOME BOUND
  Assessment and Evaluation of Home Health Team Activities 372
  Community-based Growth Group for Disabled Persons 044
  Explore Means of Utilizing the Severely Disabled Homebound to Pool Rehabilitation Se 209
  Functional, Social and Vocational Assessment of Surviving Persons with Documented 174
  Job Development and Enhanced Productivity for Severely Disabled 218
  National System for Job Development in Micrographics 207
  Project to Document the Development of a Cooperative Group Residence for Severe 184
HOME HEALTH CARE TEAM
  Assessment and Evaluation of Home Health Team Activities 372
HOMEMAKING
  Assessment and Evaluation of Home Health Team Activities 372
  Development of a Model for Evaluating the Relationship Between EMR Work/Study Pr 317
  Evaluation of Retarded Student Achievement in Career Education Programs 329
  Factors Underlying Successful Adjustment of the Retarded Released from Institutions 400
  Functional, Social and Vocational Assessment of Surviving Persons with Documented 174
  Measuring Client Gain in Group Homes for the Retarded 321
HOME PLANNING – see HOMEMAKING
HORMONE
  Dysfunctions of Endocrine Glands in Spinal Cord Injury 027
  Investigation of the Cause of Abnormal Electrolyte Distribution and Excretion in Men 123
HOSPITALIZATION – see also EXTENDED HEALTH CARE FACILITY
  Brown University-VR-CHIP-RT-7 Program 189
  Community Hospital as a System 347
  Evaluation of the Relationship of Self-Care Outcomes to Care in the Acute Hospital. 055
  Functional, Social and Vocational Assessment of Surviving Persons with Documented 174
  Identification of Patients who Need Rehabilitation Services 348
HOSPITAL ORGANIZATION – see EXTENDED HEALTH CARE FACILITY

HOSPITAL PATIENTS – see HEALTH CARE
REHABILITATION CLIENTS
HOSPITAL STAFFING – see ALLIED HEALTH PERSONNEL
HOUSEKEEPING – see also HOMEMAKING
Factors Underlying Successful Adjustment of the Retarded Released from Institutio 400
Functional, Social and Vocational Assessment of Surviving Persons with Documen 174
HOUSEPARENT – see EXTENDED CARE FACILITY
GROUP HOME
HOUSING
Cost Analysis and Program Budgeting of Community Residential Facilities and Re 320
Project to Document the Development of a Cooperative Group Residence for Se 184
Study of Consumer Needs, Circumstances and Attitudes 406
H-REFLEX – see MUSCLE STUDY
NERVE CONDUCTION
HUMAN GROWTH HORMONE – see GROWTH
HORMONE
HYDROTHERAPY – see THERAPY
HYPERBARIC OXYGEN TREATMENT
Modular Hyperbaric Oxygen Treatment of Pressure Sores and Traumatic Skin Lesio 032
Topical Hyperbaric Oxygen Treatment of Pressure Sores and Certain Skin Ulceratio 020
HYPERCALCEMIA – see MINERAL
HYPERCAPNEA – see RESPIRATORY DISORDER
HYPERKINESIS – see also KINESIOLOGY
Effects of Specific Cutaneous Cold Stimulation on Motor Control in Cat and Man 150
HYPERTENSION – see BLOOD PRESSURE
HYPERTONIA – see MUSCULAR DISORDER
HYPERURICEMIA – see URINARY DISORDER
HYPERVENTILATION – see RESPIRATORY DISORDER
HYPGLOSSAL NERVE – see SPEECH
HYPOTENSION – see BLOOD PRESSURE
HYPOXEMIA – see RESPIRATORY DISORDER

IDIOPATHIC SCOLIOSIS – see SPINAL COLUMN
ILEAC DIVERSION – see DIGESTIVE SYSTEM
ILLINOIS TEST OF PSYCHOLINGUISTIC ABILITIES
ITPA Testing of Milwaukee Children 240
IMMUNOFLUORESCENCE – see IMMUNOLOGY
IMMUNOLOGY
Localization of Urinary Tract Infection by Identifying Bacterial Antibody-Coating with 363
Studies of Urologic Function in Patients Following Spinal Cord Injuries 045
INCENTIVE PREFERENCE – see MOTIVATION
INCONTINENCE – see BOWEL
INCOME – see FINANCING
INCREMENTAL STIMULUS EFFECT – see STIMULATION
INDEPENDENT LIVING
Clinical Field Trials of the Emory Detachable Electric Powered Drive for the Standard 160
Community Group Homes for the Developmentally Disabled 318
Development of a Model for Evaluating the Relationship Between EMR Work/Study Pr 317
Development of Electronic Systems to Provide Increased Vocational Independence a 034
Engineering Analysis and Evaluation of a New Radial Palsy Splint 169
Evaluation of Halfway House Training Programs for the Mentally Retarded 390
Evaluation of Retarded Student Achievement in Career Education Programs 329
Evaluation of Various Electronic Devices to Increase Mobility and Independence of V 028
Identification of Work Reinforcers Found in Sheltered Workshops and their Relationship 410

Longitudinal Study of Quadriplegic Young Adults in a Cooperative Self-Support Resid 133
Medical Examinations of a Selected Sample from the Study of Highland Heights, a M 186
Predicting Rate of Acquisition and Production of Complex Industrial Tasks by Institutio 322
Predictor Feedback Technology for Electromyographic Control of Prosthetic and Orth 173
Preliminary Investigation of Micrographic Viewer for Use by Disabled Persons 371
Program for the Analysis of Deinstitutionalization Resources 319
Project to Document the Development of a Cooperative Group Residence for Severe 184
Research Needs in Vocational Rehabilitation 327
Sociological Look at the Impact of Normalization 328
Study of Factors Related to Personal Independence Gains of Spinal Cord Injured Pati 142
Study of Residential Environments for Physically Disabled Young Adults in Houston, Tex 134
Technology Assessment: Human Rehabilitation Techniques 403
INDEXING – see INFORMATION ACTIVITY
INDIVIDUAL DIFFERENCES – see PERSONALITY
SELF-REGULATION
INFANT – see CHILDREN
INFECTION
Enterobacterial Vaccine as a Means of Controlling Infections in Spinal Cord Injured P 127
Localization of Urinary Tract Infection by Identifying Bacterial Antibody-Coating with 363
Prevention of Urinary Tract Infection in Spinal Cord Injury 385
Renal Scintillation Camera Studies as a Method of Following Renal Function and Urol 368
Use of Acetohydroxamic Acid (AHA) in Humans 135
INFORMATION ACTIVITY
Consumer Advocacy Project 171
Determining the Feasilbility of a National Cooperative for the Development and Distrib 336
Feedback Systems for Insuring Quality in Facility Based Services 411
Multimedia Rehabilitation Resource Center Project 210
Preliminary Investigation of Micrographic Viewer for Use by Disabled Persons 371
Program Evaluation – Modular Information System to Evaluate Rehabilitation 310
Rehabilitation Information System (REHABIS) 384
Rehabilitation Training Materials Study 211
INFORMATION SYSTEM – see DATA COLLECTION
INFORMATION ACTIVITY
INHALATION THERAPY – see also RESPIRATION
THERAPY
Controlled Study of Inhalational Therapy in the Rehabilitation of Patients with Chronic 001
Technology Assessment: Human Rehabilitation Techniques 403
INNER CITY RESIDENTS – see MINORITY GROUP
URBAN PROBLEM
INNERVATION – see NERVE STUDY
INSTITUTION
Cooperation and Competition Skills of the Institutionalized Mentally Retarded 393
Evaluation of the Relationship of Self-Care Outcomes to Care in the Acute Hospital, th 055
Factors Underlying Successful Adjustment of the Retarded Released from Institutions 400
Group Homes for the Mentally Retarded in the Rehabilitation Process 398
Program for the Analysis of Deinstitutionalization Resources 319
Role of Family in Institutional Rehabilitation of Clients with Behavioral and Physical Dis 220
Sociological Look at the Impact of Normalization 328
INSTITUTIONAL CARE – see EXTENDED CARE FACILITY
HEALTH CARE
HOSPITALIZATION
INSTITUTION
INSTRUCTIONAL MATERIAL – see AUDIOVISUAL AID
TEACHING TOOL
INSTRUCTIONAL METHODS – see TEACHING
TRAINING
INSTRUMENTATION – see EQUIPMENT

INSULIN – see DIABETES
    HORMONE
INSURANCE – see also FINANCING
    HEALTH CARE
  Brown University-VR-CHIP-RT-7 Program 189
INTELLECTUAL ADJUSTMENT – see EMOTION
INTELLIGENCE
  Process and Outcome in Cooperative School Programs in Texas 404
  Sociological Look at the Impact of Normalization 328
  Standardization of a Technique to Facilitate Indexing Differential Development in Pre 243
  Technology Assessment: Human Rehabilitation Techniques 403
INTERDISCIPLINARY APPROACH – see MULTIDISCIPLINARY APPROACH
INTERMITTENT CATHETERIZATION – see CATHETER
INTERORGANIZATIONAL RELATIONSHIPS – see AGENCY
    STATE AGENCY
INTEROSSEUS – see BONE
INTERPERSONAL SKILL – see SKILL
INTERPERSONAL SKILLS TRAINING – see TRAINING
INTERPRETER FOR THE DEAF
  Continuing Assessment of Programs for Preparation of Professionals to Work with Deaf 331
  Development of Videotapes for Application in Training Rehabilitation Counselors to 344
  Model Casefinding, Counseling and Referral Program for Deaf People 332
  National Interpreter Training Consortium 345
  Technology Assessment: Human Rehabilitation Techniques 403
INTERSTIMULUS INTERVAL EFFECT – see STIMULATION
INTERVIEW
  Development of Videotapes for Application in Training Rehabilitation Counselors to 344
  Factors Underlying Successful Adjustment of the Retarded Released from Institutions 400
  Follow-up Study of Rehabilitation Short-Term Training 325
  Functional, Social and Vocational Assessment of Surviving Persons with Documented 174
  Rehabilitation Policy Studies Part II: Quality Assurance 039
  Study of Consumer Needs, Circumstances, and Attitudes 406
  Supervision in Vocational Rehabilitation 326
INTRACELLULAR STUDY – see CELLULAR STUDY
INTRACRANIAL PRESSURE – see BRAIN
INTRAVENOUS PYELOGRAM
  Renal Scintillation Camera Studies as Method of Following Renal Function and Urologi 368
ISCHEMIC HEART DISEASE – see CARDIAC DISORDER
ISCHEMIC THROMBOTIC CEREBROVASCULAR DISEASE (ITCVD) – see STROKE
    VASCULAR DISORDER
ISCHEMIC ULCERS – see PRESSURE SORE
    SKIN DISORDER
    ULCER
ISOENZYME – see ENZYME
ISOMETRICS – see PHYSICAL ACTIVITY
ITCVD – see STROKE
    VASCULAR DISORDER
ITPA – see LANGUAGE

J

JOB – see EMPLOYMENT
    WORK
JOB DEVELOPMENT
  Analysis of Information Processing Training for the Severely Disabled 143
  Development of a General Purpose Vocational Assessment Technique 388

  - Explore Means of Utilizing the Severely Disabled Homebound to Pool Rehabilitation Se 209
  - Follow-Along Study of Clients Returned for Service to a State Rehabilitation Agency 170
  - Job Development and Enhanced Productivity for Severely Disabled 218
  - National System for Job Development in Micrographics 207
  - Opening Science Careers to the Handicapped 212
  - Predicting Rate of Acquisition and Production of Complex Industrial Tasks by Institution 322
  - Study of the Development and Change of Attitudes of Medical Students Throughout th 040
  - Technology Assessment: Human Rehabilitation Techniques 403
- JOB EXPERIENCE – see WORK EXPERIENCE
- JOINT
  - Comparison of Two Dosage Schedules of Gold in the Treatment of Rheumatoid Arthriti 136
  - Evaluation of an Automatic Knee Locking Mechanism for a Knee Ankle Orthoses 075
  - Research in Upper and Lower Extremity Orthotics 177
  - Incorporation of a Lexan Check Socket into a Definitive Patellar Tendon Bearing Prosth 114
  - Postoperative Care of Patients with Total Hip Joint Replacement Using Ultrasound 096
  - Quantification of the Biomechanical Function of Various Designs and Adjustments of A 101
- JUNIOR HIGH SCHOOL – see EDUCATION
  - HIGH SCHOOL
- JUVENILE – see YOUTH
- JUVENILE DELINQUENCY – see DELINQUENCY
  - CHILDREN

K

- KENNY SELF-CARE EVALUATION SYSTEM – see EVALUATION
- KIDNEY FUNCTION – see URINARY DISORDER
- KIDNEY TRANSPLANT – see TRANSPLANT
  - URINARY DISORDER
- KINESIOLOGY – see also HYPERKINESIS
  - MOVEMENT
  - Correlative Kinesiology 016
  - Effect of Cervical Orthoses on Cervical Spine Motion: A Standardized Radiographic M 065
  - Effects of Specific Cutaneous Cold Stimulation on Motor Control in Cat and Man 150
  - Engineering Analysis and Evaluation of a New Radial Palsy Splint 169
  - Motor Control and its Relationship to Functional Activities 202
  - Motor Unit Composition and Voluntary Force in Neuromuscular Disease 201
  - Multi-Electrode Studies of Patients with Spastic Central Nervous System Disorders 199
  - Pathomechanics of Upper Limbs as a Basis for Improved Prosthetic and Orthotic Design 033
  - Quantitative Studies of Muscular Strength and Muscular Work 050
  - Spinal Muscular Tone of Scoliosis Patients in Siblings 151
- KITCHEN – see HOME
  - HOME MAKING
- KNEE – see EXTREMITY
  - JOINT
- KYPHOSCOLIOSIS – see SPINAL COLUMN
- KYPHOSIS – see SPINAL COLUMN

L

- LACTATE-see BIOCHEMISTRY
- LANGUAGE
  - Berko Morphology 241
  - Bibliography of Language Acquisition and Black Dialect 248
  - Black Language Studies 175
  - Computer Aided Motor Communication for the Severely Disabled Non-Verbal 182
  - Crisis Intervention Rehabilitation Applied Research Program for the Severely Developme 258

Establishment of the High-Risk Population Laboratory 257
Free Speech Language Analysis 239
Grammatical Comprehension of Pre-School Children 238
Grammatical Comprehension Test 237
Information Transmission in the Mother-Child Dyad 242
ITPA Testing of Milwaukee Children 240
Learning Strategies of Deaf and Hearing Adults 339
Modification of Nasality in Utterances of Deaf Speakers 360
Modified Sentence Repetition Test II 249
National Interpreter Training Consortium 245
Serving Deaf Rehabilitation Clients: Fundamentals of Communication 273
Standardization of a Technique to Facilitate Indexing Differential Development in Pre-Lit 243
Study of Consumer Needs, Circumstances, and Attitudes 406
Study of Cortical Organization Using Visual and Somatosensory Evoked Potentials 217
Study of the Muscle Spindle of the Human Tongue Muscle 043
Technology Assessment: Human Rehabilitation Techniques 403
Temporal Factors in Recovery from Aphasia 017
Use of Sentence Repetition Test II in Evaluating Language Acquisition in Populations with V 250
Use of a Sentence Repetition Test in Evaluating the Differential Acquisition of Languag 236
Voice Activated Transducer for Severely Physically Disabled 188
Word Association Among Low SES Children 251

LDH ISOENZYME STUDY – see COLLAGEN DISEASE

LEARNING
Analysis of Longitudinally Derived Data by a Programmed Statistical Package 247
Behavior Modification: A Problem-Oriented, Learning-Based Research Strategy for Reh 061
Crisis Intervention Rehabilitation Applied Research Program for the Severely Developme 258
Development of Stimulus Material for Research and Teaching Apparatus 244
Differential Appreciation of Color and Form by Young Children 246
Establishment of the High-Risk Population Laboratory 257
Grammatical Comprehension Test 237
Grammatical Comprehension of Pre-School Children 238
Hypoxia and Cognitive Functions in Cardiovascular and Obstructive Pulmonary Diseas 235
Information Transmission in the Mother-Child Dyad 242
Learning Strategies of Deaf and Hearing Adults 339
Modified Sentence Repetition Test II 249
Oddity Discrimination in Young Children 245
Predicting Rate of Acquisition and Production of Complex Industrial Tasks by Institutiona 322
Standardization of a Technique to Facilitate Indexing Differential Development in Pre-Lit 243
Use of a sentence Repetition Test in Evaluating the Differential Acquisition of Langua 236
Use of Sentence Repetition Test II in Evaluating Language Acquisition in Populations with 250
Word Association Among Low SES Children 251

LEFT ASIS DEVIATION – see CARDIAC DISORDER

LEG – see EXTREMITY

LEGISLATION – see LAW

LEVEL OF CORD LESION – see SPINAL CORD DISORDER

LEVISON GERONTOLOGICAL POLICY INSTITUTE – see AGED
AGENCY

LIFE SKILL – see ACTIVITY OF DAILY LIVING
SKILL

LIMB – see EXTREMITY

LIMITED WEIGHT BEARING – see CANE
CRUTCH
REHABILITATION DEVICE

LINGUAL FRENULUM – see FACIAL DISORDER
SPEECH

LIP MUSCLE – see FACIAL DISORDER
SPEECH

LIORASIA – see ANTISPASTIC DRUG
LISSORIL – see ANTISPASTIC DRUG
LITERATURE REVIEW – see LITERATURE SURVEY
REVIEW
LITERATURE SURVEY
Bibliography of Language Acquisition and Black Dialect 248
Comprehensive Evaluation of the Relationship Between Disability and Personality Functio 289
Follow-up Study of Patients Treated in the Pain Treatment Program: Physical Medicine an 062
Quality Assurance in Rehabilitation 349
Rehabilitation of the End-Stage Renal Disease Client – Selected Readings 295
Research on the Psychosocial and Vocational Adjustment of Spinal Cord Injured Clien 285
Review and Analysis of Drug Treatment Literature 268
Serving Deaf Rehabilitation Clients: Fundamentals of Communication 273
Summary of the Results of Rehabilitation Counseling Research: 1955-1974 276
Training Evaluation Kit 323
LIVER – see DIGESTIVE SYSTEM
LIVING UNIT FOR REHABILITATION PATIENT – see HOUSING
LOCOMOTION – see AMBULATION
LOCUS OF CONTROL
Effects of Vocational Evaluation on Vocational Rehabilitation 309
Information Transmission in the Mother-Child Dyad 242
LONGITUDINAL STUDY – see RESEARCH PROGRAM
LONG LEG BRACE – see ORTHOSIS
PROSTHESIS
LOWER EXTREMITY – see EXTREMITY
LOWER MOTOR NEURON LESION – see NERVE DISORDER
LOW SOCIO-ECONOMIC CLASS – see DISADVANTAGED SOCIO-ECONOMIC CLASS
LUNG – see RESPIRATION
LUNG DISEASE
Assessment of Hypoxia and Reduced Ventilitory Drive in Pulmonary Disability 227
Controlled Study of Inhalational Therapy in the Rehabilitation of Patients with Chronic Obst 001
Day Care Pulmonary Rehabilitation Program Evaluation 381
Hypoxia and Cognitive Functions in Cardiovascular and Obstructive Pulmonary Disease 235
Natural History of Deep-Vein Thrombosis in the Spinal Cord Injured 386
Technology Assessment: Human Rehabilitation Techniques 403
Use of Periodic Lung Expansion for the Facilitation and Rehabilitation and Prevention 004
LUNG EXPANSION – see RESPIRATORY DISORDER

M

MAINTENANCE OF EMPLOYMENT – see EMPLOYMENT
WORK
MANAGEMENT
Conceptual Model of Planning and Evaluation of Rehabilitation Services 383
Development of a Systematic Problem Solving Approach to the Practice of Rehabilita 042
Evaluation of Efficacy of Rehabilitation Programs 052
Factors Influencing Counselors Determination of Client Eligibility and Referral for Facilit 417
Factors Influencing Vocational Rehabilitation Counselor Utilization of Vocational Evalu 408
Feedback Systems for Insuring Quality in Facility Based Services 411
National System for Job Development in Micrographics 207
Simplified Model for Cost-Benefit Analysis in Rehabilitation Programs 313
Statistical Collection System for a Medical Rehabilitation Facility 181
Study of the Development and Change of Attitudes of Medical Students Throughout t 040
Supervision in Vocational Rehabilitation 326
Systems Analysis of the Delivery of Rehabilitation Services in a Rural Setting 229
Telecommunications in Training of Rehabilitation Facility Personnel 415
MANAGEMENT SYSTEMS ANALYSIS – see EVALUATION
MANAGEMENT

MANDIBULAR FUNCTION – see FACIAL DISORDER
SPEECH
MAN-MACHINE SYSTEM
  Comparative Clinical Evaluation of Several EMG Processing Techniques 164
MANUAL – see HANDBOOK
MANUAL COMMUNICATION – see COMMUNICATION
INTERPRETER FOR THE DEAF
MARIJUANA – see DRUG ABUSE
MAT WALKER – see REHABILITATION DEVICE
MATTRESS – see REHABILITATION DEVICE
MEASUREMENT – see OUTCOME ASSESSMENT
RATING SCALE
TESTS
MECHANICAL DEVICE – see REHABILITATION DEVICE
MEDICAID – see FEDERAL GOVERNMENT
FINANCING
MEDICAL CARE FOR THE AGED – see AGED
HEALTH CARE
MEDICAL CONSULTATION – see DIAGNOSIS
MEDICAL EDUCATION – see EDUCATION
MEDICALLY DISABLED
  Clinical Assessment of Psychological Adjustment to Spinal Cord Injury 365
  Community-Based Maintenance Care for the Long-Term Patient (Planning Grant to De 166
  Conceptual Model of Planning and Evaluation of Rehabilitation Services 383
  Functional Achievement Evaluation RIC Tenodesis Splint 375
  Functional, Social and Vocational Assessment of Surviving Persons with Documented 174
  Predictor Feedback Technology for Electromyographic Control of Prosthetic and Orthotic 173
  Prevention of Urinary Tract Infection in Spinal Cord Injury 385
  Rehabilitation Follow-up Program 380
  Survey of Comprehensive Medical Rehabilitation Centers Serving the Most Severely 378
  Vocational Follow-up of the Physically Restored Unemployed 387
MEDICAL RECORD
  Community Hospital as a System 347
  Development of a Systematic Problem Solving Approach to the Practice of Rehabilita 042
  Exercise Prescription in the Hospital 350
  Identification of Patients who Need Rehabilitation Services 348
  Medical Information System as a Communication Link: The State Agency Medical Rec 353
MEDICAL SCHOOL PROGRAM – see EDUCATION
MEDICAL STUDENT – see STUDENT
MEDICARE – see AGED
FEDERAL GOVERNMENT
FINANCING
HEALTH CARE
MEDICINE
  Effective Training in Rehabilitation Medicine in New Medical School Curricula 113
  Study of the Development and Change of Attitudes of Medical Students Throughout t 040
  Technology Assessment: Human Rehabilitation Techniques 403
MEMBRANE – see TISSUE STUDY
MEMORY
  Development and Application of New Testing Procedures to the Study of Captions an 334
  Technology Assessment: Human Rehabilitation Techniques 403
MENIERE'S DISEASE – see DEAF
HEARING
COORDINATION
MENINGOMYELOXOELE – see SPINAL CORD DISORDER

MENTALLY DISTURBED
  Diagnosis and Remediation of Deficits in Visual Information Processing and Verbal 035
  Role of Family in Institutional Rehabilitation of Clients with Behavioral and Physical Dis 220
  Technology Assessment: Human Rehabiliation Techniques 403
MENTALLY RETARDED
  Hypoxia and Cognitive Functions in Cardiovascular and Obstructive Pulmonary Disea 235
  Analysis of Longitudinally Derived Data by a Programmed Statistical Package 247
  Analysis of Public Assistance/Social Services for the Mentally Retarded 324
  Behavioral Architecture: Ecological Designing of Facilities for the Mentally Retarded 389
  Client, Family, School and Community Variables Related to the Educational-Rehabilit 254
  Community Group Homes for the Developmentally Disabled 318
  Cooperation and Competition Skills of the Institutionalized Mentally Retarded 393
  Cost Analysis and Program Budgeting of Community Residential Facilities and Rehabil 320
  Crisis Intervention Rehabilitation: Applied Research Program for the Severely Develop 258
  Delegation of Homemaking Responsibilities to the Mentally Retarded in Three Environ 399
  Developing an Empirically Based Training Program in Mental Retardation 397
  Development of a General Purpose Vocational Assessment Technique 388
  Development of a Model for Evaluating the Relationship Between EMR Work/Study 317
  Development of Stimulus Material for Research and Teaching Apparatus 244
  Differential Appreciation of Color and Form by Young Children 246
  Effects of Special Olympics Participation on Retarded Children, Families, and Comm 401
  Establishment of the High-Risk Population Laboratory 257
  Evaluation of Halfway House Training Programs for the Mentally Retarded 390
  Evaluation of Retarded Student Achievement in Career Education Programs 329
  Evaluation of Three Citizen Advocacy Programs 396
  Extending Rehabilitation Services to the Multiply Handicapped 402
  Factors Underlying Successful Adjustment of the Retarded Released from Institutions 400
  Group Homes for the Mentally Retarded in the Rehabilitation Process 398
  Health Services for Developmentally Disabled Adults 376
  Home Management Education for the Mentally Retarded 255
  Information Transmission in the Mother-Child Dyad 242
  Investigation of the Mentally Retarded Clients Both Rehabilitated and nonrehabilitate 256
  Longitudinal Study of the Social, Vocational, Legal and Family Status of Young Adult 259
  Measuring Client Gain in Group Homes for the Retarded 321
  Oddity Discrimination in Young Children 245
  Personal-Social Functioning of Cooperative Work-Study Students: Parents' Perspectives 394
  Predicting Rate of Acquisition and Production of Complex Industrial Tasks by Institutio 322
  Process and Outcome in Cooperative School Programs in Texas 404
  Program for the Analysis of Deinstitutionalization Resources 319
  Research Needs in Vocational Rehabilitation 327
  Social and Community Living Skill Training of Mentally Retarded Adults: A Compariso 395
  Sociological Look at the Impact of Normalization 328
  Standardization of a Technique to Facilitate Indexing Differential Development in Pre- 243
  State Agency Rehabilitation Counselor Functions and the Mentally Retarded 405
  Study of Consumer Needs, Circumstances, and Attitudes 406
  Supervision in Vocational Rehabilitation 326
  Technology Assessment: Human Rehabilitation Techniques 403
  Vibrotactile Learning with Mentally Retarded Subjects 391
METABOLISM STUDY
  Physiologic Responses of Hemiparetic Patients to Specific Exercise Stress 168
  Sympathetic Activity and the Metabolism of Biogenic Amines in Spinal Cord Injured P 026
METHODOLOGY – see RESEARCH PROGRAM
METHYLMETHACRYLATE – see BIOCHEMISTRY
MICROGRAPHICS
  Job Development and Enhanced Productivity for Severely Disabled 218
  National System for Job Development in Micrographics Preliminary Investigation of 207
  Preliminary Investigation of Micrographic Viewer for Use by Disabled Persons 371
MICROWAVE – see RADIATION

MICTURITION – see also URINARY DISORDER
Evaluation of Long-Term Urinary Sterilization in Catheter-Free Paraplegics 362
Long-Term Follow-up Studies of Patients with Spinal Cord Injury who Became Catheter 369
Renal Scintillation Camera Studies as a Method of Following Renal Function and 368
Studies of Urologic Function in Patients Following Spinal Cord Injuries 045
MILDLY RETARDED – see MENTALLY RETARDED
MILWAUKEE PROJECT
Analysis of Longitudinally Derived Data by a Programmed Statistical Package 247
Berko Morphology 241
Bibliography of Language Acquisition and Black Dialect 248
Development of Stimulus Material for Research and Teaching Apparatus 244
Differential Appreciation of Color and Form by Young Children 246
Establishment of the High-Risk Population Laboratory 257
Free Speech Language Analysis 239
Grammatical Comprehension of Pre-School Children 238
Grammatical Comprehension Test 237
Information Transmission in the Mother-Child Dyad 242
ITPA Testing of Milwaukee Children 240
Modified Sentence Repetition Test II 249
Oddity Discrimination in Young Children 245
Standardization of a Technique to Facilitate Indexing Differential Development 243
Technology Assessment: Human Rehabilitation Techniques 403
Use of Sentence Repetition Test II in Evaluating Language Acquisition in Populations 250
Use of a Sentence Repetition Test in Evaluating the Differential Acquisition of Lang 236
Word Association Among Low SES Children 251
MINERAL
Clinical Studies of Calcium in Quadriplegia: Collagen Metabolites and Bone Related 138
Effect of Disodium Etidronate (Diphosphonate) on Acute Osteoporosis 354
Effect of Disodium Etidronate on the Recurrence of Ectopic Calcification Following 361
MINERAL METABOLISM – see METABOLISM
MINERAL RELATED DISORDERS – see MINERAL
MINNESOTA IMPEDANCE CARDIOGRAPHY – see CARDIAC
MINIMAL LANGUAGE SKILLS – see LANGUAGE
MINI-MULT
Homogeneous Sub-Scales for the Mini-Mult 272
MINORITY GROUP
Black Language Studies 175
Personal-Social Functioning of Cooperative Work-Study Students: Parents' Perspectives 394
Service Delivery Model for Deaf Inner City Residents 342
MOBILITY LIMITED
Assessment of Driving Capabilities of the Brain Injured Population 206
Clinical Field Trials of the Emory Detachable Electric Powered Drive for the Standard 160
Comparative Clinical Evaluation of Several EMG Processing Techniques 164
Homotransplantation of Total Hip Joint Articular Cartilage in Dogs 176
Incorporation of a Lexan Check Socket into a Definitive Patellar Tendon Bearing Prost 114
Job Development and Enhanced Productivity for Severely Disabled 218
Motor Control and Its Relationship to Functional Activities 202
Reducing Public Barriers of the Severely Handicapped 377
Enhancing the Responsiveness of the Rehabilitation Service Delivery System to the 304
Variables Related to the Attainment of Occupational Status Among Deaf Adults 340
MODEL
Brown University-VR-CHIP-RT-7 Program 189
Comparison of Differential Modeling Strategies in Counselor Training 277
Conceptual Model of Planning and Evaluation of Rehabilitation Services 383
Crisis Intervention Rehabilitation Applied Research Program for the Severely Develop 258
Effects of Different Types of Frustrating Conditions on the Behavior of Institutionalized 252
Effects of Vocational Evaluation Programming on the Vocational Development of Rur 409

  Feedback Systems for Insuring Quality in Facility Based Services 411
  Implementation of the Model State Plan for Vocational Rehabilitation of Deaf Clients 337
  Job Development and Enhanced Productivity for Severely Disabled 218
  Model Casefinding, Counseling and Referral Program for Deaf People 332
  Model State Plan Inventory 341
  Pattern-Probability Model for Predicting Client Outcome 270
  Service Delivery Model for Deaf Inner City Residents 342
  Social and Community Living Skill Training of Mentally Retarded Adults: A Comparison 395
  Technology Assessment: Human Rehabilitation Techniques 403
MODELING – see MODEL
MODELING PROCEDURES – see MODEL
MORPHOLOGY – see LANGUAGE
                    SPEECH
MORTALITY
  Functional, Social and Vocational Assessment of Surviving Persons with Documented 174
MOTHER-CHILD INTERACTION – see PARENT
MOTIVATION
  Crisis Intervention Rehabilitation Applied Research Program for the Severely Developm 258
  Extending Rehabilitation Services to the Multiply Handicapped 402
  Sociological Look at the Impact of Normalization 328
  Study of the Development and Change of Attitudes of Medical Students Throughout th 040
MOTOR COMMUNICATION
  Application of Dynamic Palatography in Organic Speech Disorders 195
  Computer Aided Motor Communication for the Severely Disabled Non-Verbal 182
  Predictor Feedback Technology for Electromyographic Control of Prosthetic and Ortho 173
  Voice Activated Transducer for Severely Physically Disabled 188
MOTOR CONTROL
  Application of Dynamic Palatography in Organic Speech Disorders 195
  Control of Spasticity with EMG Biofeedback in the Incomplete Spinal Cord Injured Pati 111
  Comparative Clinical Evaluation of Several EMG Processing Techniques 164
  Development of a General Purpose Vocational Assessment Technique 388
  Electromyographic Findings in the Upper and in the Lower Motor Neuron Diseases: A 355
  Engineering Analysis and Evaluation of a New Radial Palsy Splint 169
  Functional Achievement Evaluation RIC Tenodesis Splint 375
  Fundamental Study of Human Locomotion 190
  H-Reflex as an Indicator of Spinal Center Integrity 357
  Improvement of Function of Spastic and Stroke Patients by Means of Biofeedback 158
  Incorporation of a Lexan Check Socket into a Definitive Patellar Tendon Bearing Prost 114
  Modification of Speech Patterns of Normal and Dysarthric Speakers as a Function of 116
  Motor Control and its Relationship to Functional Activities 202
  Multi-Electrode Studies of Patients with Spastic Central Nervous System Disorders 199
  Postural Control in Neurosensory Disability: Functional Implications and Therapeutic 191
  Postural Control in the Initiation of Gait: Normal and Pathological Mechanisms 196
  Predictor Feedback Technology for Electromyographic Control of Prosthetic and Ortho 173
  Quantitative and Qualitative Evaluation of Muscular Hypertonia in Patients with Central 047
  Research in Upper and Lower Extremity Orthotics 177
  Role of Feedback in Control of Motor Function 198
  Spinal Muscular Tone of Scoliosis Patients in Siblings 151
  Technology Assessment: Human Rehabilitation Techniques 403
  Training Program for Upper Extremity Activities in Athetoid Patients 049
  Use of Motor Unit Potentials as a Measure of Neuromuscular Integrity 162
MOTOR FUNCTION – see MUSCLE STUDY
MOTOR LEARNING
  Application of Dynamic Palatography in Organic Speech Disorders 195
  Behavior Modification: A Problem-Oriented, Learning-Based Research Strategy for 061
  Cognitive Assist in Motor Learning 156
  Hypoxia and Cognitive Functions in Cardiovascular and Obstructive Pulmonary Diseas 235

Improvement of Function of Spastic and Stroke Patients by Means of Biofeedback 158
Predicting Rate of Acquisition and Production of Complex Industrial Tasks by Institution 322
Predictor Feedback Technology for Electromyographic Control of Prosthetic and Ortho 173
Process and Outcomes of Vocational Evaluation Services 412
Quantitative and Qualitative Evaluation of Muscular Hypertonia in Patients with Central 047
Standardization of a Technique to Facilitate Indexing Differential Development in Pre-Li 243
Training Program for Upper Extremity Activities in Athetoid Patients 049
MOTOR NEURON DISEASE – see NERVE DISORDER
MOTOR NEURON LESION – see NERVE DISORDER
MOTOR POINT BLOCK – see NERVE STUDY
MOTOR SKILL – see NERVE STUDY and SKILL
MOTOR TEST – see NERVE STUDY and SKILL
MOTOR TRAINING – see MUSCLE STUDY
MOVEMENT – see also KINESIOLOGY
Effect of Cervical Orthoses on Cervical Spine Motion: A Standardized Radiographic Meth 065
Engineering Analysis and Evaluation of a New Radial Palsy Splint 169
Functional, Social and Vocational Assessment of Surviving Persons with Documented 174
Fundamental Study of Human Locomotion 190
Homotransplantation of Total Hip Joint Articular Cartilage in Dogs 176
Improvement of Function of Spastic and Stroke Patients by Means of Biofeedback 158
Mapping of Microwave Fields Surrounding Human Subjects under Diathermy Treatmen 120
Measurement of Musculature Blood Flow Induced by Microwave Diathermy 119
Multi-Electrode Studies of Patients with Spastic Central Nervous System Disorders 199
Predictor Feedback Technology for Electromyographic Control of Prosthetic and Ortho 173
Quantitative and Qualitative Evaluation of Muscular Hypertonia in Patients with Central N 047
Research in Upper and Lower Extremity Orthotics 177
Role of Feedback in Control of Motor Function 198
Scientific and Clinical Testing of new Experimental Drugs 161
Spinal Muscular Tone of Scoliosis Patients in Siblings 151
Technology Assessment: Human Rehabilitation Techniques 403
Training Program for Upper Extremity Activities in Athetoid Patients 049
MTM
Employment Potential of the Severely Disabled Young Adult 157
MULTIDISCIPLINARY APPROACH
Development of a Model Demonstration Rehabilitation Service 203
Functional, Social and Vocational Assessment of Surviving Persons with Documented 174
Rehabilitation Policy Studies Part II Quality Assurance 039
Sociological Look at the Impact of Normalization 328
Study of the Development and Change of Attitudes of Medical Students Throughou 040
Technology Assessment: Human Rehabilitation Techniques 403
MULTIPLE DISABILITY
Functional, Social and Vocational Assessment of Surviving Persons with Documented 174
Health Services for Developmentally Disabled Adults 376
Identification of Deaf-Blind Individuals and the Development of Education & Rehabilita 392
Technology Assessment: Human Rehabilitation Techniques 403
MULTIPLE SCLEROSIS – see MOTOR CONTROL
NERVE STUDY
MULTIPLY HANDICAPPED – see DISABLED
MULTIPLE DISABILITY
MULTIVARIATE ANALYSIS – see SYSTEM ANALYSIS
MUSCLE RELAXANT DRUG – see ANTISPASTIC DRUG
MUSCLE SPINDLE – see CELLULAR STUDY
MUSCLE STUDY
MUSCLE STUDY
Assessment of the Effect of Pacing on Quadriceps Strengthening 072
Comparative Clinical Evaluation of Several EMG Processing Techniques 164
Effects of Specific Cutaneous Cold Stimulation on Motor Control in Cat and Man 150
Electromyographic and Cystometrographic Study of Human Bladder 382

- Electromyographic Findings in the Upper and in the Lower Motor Neuron Diseases: A Differ 355
- Etiology, Prognosis, and Effects of Treatment in Bell's Palsy 165
- Further Studies of the Patho-Physiology of Spasticity 192
- Gastrocnemius Muscle and Tendon Length in Normal and Stroke Patients 105
- H-Reflex as an Indicator of Spinal Center Integrity 357
- Mapping of Microwave fields Surrounding Human Subjects under Diathermy Treatmen 120
- Measurement of Musculature Blood Flow induced by Microwave Diathermy 119
- Mechanism and Treatment of Muscle Contracture in Disabling Diseases 100
- Motor Conduction Velocity Measurement in Myotonic Dystrophy 030
- Multi-Electrode Studies of Patients with Spastic Central Nervous System Disorders 199
- Quantitative and Qualitative Evaluation of Muscular Hypertonia in Patients with Central N 047
- Quantitative Studies of Muscular Strength and Muscular Work 050
- Study of Artifacts of Electrodiagnostic Testing in Severe Neurological Disabilities 083
- Study of the Changes in the Structure, Ultrastructure, Innervation and Enzymes of Skele 048
- Study of the Golgi Tendon Organ in Human Muscles and Tendons 060
- Study of the Muscle Spindle of the Human Tongue Muscle 043

MUSCULAR DISORDER
- Continued Assessment of the Effect of Submaximal Exercise in Muscular Dystrophy 070
- Effects of Specific Cutaneous Cold Stimulation on Motor Control in Cat and Man 150
- Electromyographic Findings in the Upper and in the Lower Motor Neuron Diseases: A Differ 355
- Electrophysiological Studies in Neuromuscular Diseases 022
- H-Reflex as an Indicator of Spinal Center Integrity 357
- Motor Conduction Velocity Measurement in Myotonic Dystrophy 030
- Quantitative and Qualitative Evaluation of Muscular Hypertonia in Patients with Central N 047
- Quantitative Studies of Muscular Strength and Muscular Work 050
- Study of the Changes in the Structure, Ultrastructure, Innervation and Enzymes of Skelet 048
- Technology Assessment: Human Rehabilitation Techniques 403
- Treatment of Myositis Ossificans and Calcinosis Universalis with Disodium Etidionate 087
- Use of Motor Unit Potentials as a Measure of Neuromuscular Integrity 162
- Use of Periodic Lung Expansion for the Facilitation and Rehabiliation and Prevention 004

MUSCULAR DYSTROPHY – see DYSTROPHY
MUSCULAR DISORDER
MUSCULAR FATIGUE – see MUSCLE STUDY
MUSCLE HYPERTONIA – see MUSCULAR DISORDER
NERVE DISORDER
MYASTHENIA – see MUSCULAR DISORDER
STEROID
MYELODYSPLASIA – see SPINAL CORD DISORDER
MYLELOMENINGOCELE – see also SPINAL CORD DISORDER
MYOCARDIAL INFARCTION – see CARDIAC DISORDER
MYOELECTRIC – see MUSCLE STUDY
MYOPATHY – see MUSCULAR DISORDER
MYOSITIS OSSIFICANS – see MUSCULAR DISORDER
MINERAL
MYOTONIA – see MUSCULAR DISORDER
SPASTICITY
MYOTONIC DYSTROPHY – see MUSCULAR DISORDER
SPASTICITY
MYOTONIC REFLEX – see MUSCLE STUDY
NERVE STUDY

N

NASALITY – see FACIAL DISORDER
NATIONAL CENSUS OF THE DEAF – see CENSUS
DEAF

- NATIONAL EXERCISE AND HEART DISEASE STUDY – see CARDIAC REHABILITATION
  - PHYSICAL ACTIVITY
- NATIONAL REHABILITATION TASK FORCE ON DEAFNESS – see AGENCY
  - DEAF
  - REHABILITATION PROGRAM
- NEGATIVE INCENTIVES – see DISINCENTIVES
- NERVE CONDUCTION – see also NERVE STUDY
  - Applications of the Evoked Electrospinogram 193
  - Electromyographic Findings in the Upper and in the Lower Motor Neuron Diseases: A Differ 355
  - Functional Distinction Between Neural Systems Involved in the Disabilities of Parkinson's 115
  - H-Reflex as an Indicator of Spinal Center Integrity 357
  - Motor Conduction Velocity Measurement in Myotonic Distrophy 030
  - Nerve Conduction Measurement by the Use of Double Stimulus Technique 091
  - Nerve Conduction Studies as a Method of Differential Diagnosis of Neuropathies 187
  - Role of Feedback in Control of Motor Function 198
  - Role of Neurotransmitters in Spasticity Genesis 379
  - Study of Artifacts of Electrodiagnostic Testing in Severe Neurological Disabilities 083
- NERVE DISORDER
  - Clinical Classification and Functional Prediction: A Study of the Stroke Population 205
  - Computer Characterization of Patient Services 204
  - Electromyographic Findings in the Upper and in the Lower Motor Neuron Diseases: A Differ 355
  - Establishment of Normal Standards of the Spokes Test 172
  - Etiology, Prognosis, and Effects of Treatment in Bell's Palsy 165
  - Evaluation and Treatment of the Syndrome of Acute Arm Weakness: Multiple Distal Neuri 077
  - H-Reflex as an Indicator of Spinal Center Integrity 357
  - Nerve Conduction Studies as a Method of Differential Diagnosis of Neuropathies 187
  - Renal Scintillation Camera Studies as a Method of Following Renal Function and Urolog 368
  - Rehabilitation of Partial Peripheral Nerve Injuries in the Severely Disabled 071
  - Severe Disabling Polyneuritis of Unknown Cause: The Development of a Research Mo 099
  - Severe Physical Disabilities of Unknown Etiology 098
  - Study of Artifacts of Electrodiagnostic Testing in Severe Neurological Disabilities 083
  - Study of the Changes in the Structure, Ultrastructure, Innervation and Enzymes of Skele 048
  - Use of Motor Unit Potentials as a Measure of Neuromuscular Integrity 162
- NERVE INJURY – see NERVE DISORDER
- NERVE LATENCY – see NERVE STUDY
- NERVE PHYSIOLOGY – see NERVE STUDY
- NERVE STUDY
  - Basal Ganglia Control of Postural Adjustment 084
  - Basal Ganglia Influences on Axial and Proximal Musculature 069
  - Cybernetic Study to Control Spinal Reflex Activity in Spinal Cord Injured Patients 129
  - Electromyographic Findings in the Upper and in the Lower Motor Neuron Diseases: A Differ 355
  - Electrophysiological Studies in Neuromuscular Disease 022
  - Functional Distinction Between Neural Systems Involved in the Disabilities of Parkinson's 115
  - H-Reflex as an Indicator of Spinal Center Integrity 357
  - Motor Point Blocks Phase III 103
  - Nerve Conduction Studies as a Method of Differential Diagnosis of Neuropathies 187
  - Re-Evaluation of Sensory Testing in Neurological Patients 163
  - Retention of Habituation of Reflex Activity Mediated by the Transected Human Spinal C 145
  - Study of Artifacts of Electrodiagnostic Testing in Severe Neurological Disabilities 083
  - Use of Motor Unit Potentials as a Measure of Neuromuscular Integrity 162
- NERVOUS SYSTEM – see NERVE STUDY
- NEURITIS – see NERVE DISORDER
- NEUROGENIC BLADDER – see NERVE DISORDER
  - URINARY BLADDER
  - URINARY DISORDER
- NEUROLOGICAL DISORDER – see NERVE DISORDER
- NEUROLOGICAL ILLNESS – see NERVE DISORDER

NEUROLOGICAL TEST – see DIAGNOSIS
NERVE DISORDER
NEUROLOGY – see NERVE DISORDER
NEUROLYSIS – see NERVE DISORDER
NEUROMUSCULAR DISEASE – see MUSCULAR DISORDER
NERVE DISORDER
NEUROMUSCULAR DISORDER – see MUSCULAR DISORDER
NERVE DISORDER
NEUROMUSCULAR FUNCTION – see MUSCLE STUDY
NERVE STUDY
NEUROMUSCULAR INTEGRITY – see MOTOR CONTROL
NEURONS – see NERVE STUDY
NEUROPATHIES
- Electromyographic Findings in the Upper and in the Lower Motor Neuron Diseases: A Differ 355
- H-Reflex as an Indicator of Spinal Center Integrity 357
- Nerve Conduction Studies as a Method of Differential Diagnosis of Neuropathies 187
- Lateral Postural Control and Locomotor Performance in Normal Subjects and Patients 194
- Postural Control in Neurosensory Disability: Functional Implications and Therapeutic 191
- Re-evaluation of Sensory Testing in Neurological Patients 163
- Use of Motor Unit Potentials as a Measure of Neuromuscular Integrity 162

NEUROPSYCHOLOGY – see BRAIN DISORDER
MENTALLY DISTURBED
NEUROTOXIC CHEMICAL AGENT – see NERVE STUDY
NEUROTRANSMITTERS – see NERVE CONDUCTION
NEWBORN – see CHILD
NON-VERBAL DISABLED
- Computer Aided Motor Communication for the Severely Disabled Non-Verbal 182
- Electronically Aided Communication for the Severely Physically Disabled Non-Verbal 178
- Identification of Deaf-Blind Individuals and the Development of Education & Rehabilita 392
- Technology Assessment: Human Rehabilitation Techniques 403

NOSE – see FACIAL DISORDER
NURSES
- Assessment and Evaluation of Home Health Team Activities 372
- Functional, Social and Vocational Assessment of Surviving Persons with Documented 174
- Nursing Home Continuing Education Accountability 088

NURSING – see ALLIED HEALTH PERSONNEL
NYSTAGMUS
- Visual System Disorders and Functional Correlates 200

O

OBESITY
- Functional, Social and Vocational Assessment of Surviving Persons with Documented 174

OCCUPATIONAL EXPLORATION KIT – see WORK
SAFETY
OCCUPATIONAL THERAPY
- Functional Achievement Evaluation RIC Tenodesis Splint 375
- Technology Assessment: Human Rehabilitation Techniques 403

OCULOMOTOR – see also EYE
- Visual System Disorders and Functional Correlates 200

OPERANT CONDITIONING – see BEHAVIOR MODIFICATION
OPERANT LEARNING – see BEHAVIOR MODIFICATION
OPHTHALMOLOGY – see EYE
ORAL – see FACIAL DISORDER and SPEECH
ORGANIZATION DEVELOPMENT – see QUALITY ASSURANCE
ORGANIZING – see INFORMATION ACTIVITY

ORTHODROMIC SENSORY NERVE CONDUCTION – see NERVE STUDY
ORTHOPEDIC – see BONE DISORDER
ORTHOSIS
  Comparison of Pneumatic and Conventional Double Upright Orthoses 090
  Effect of Cervical Orthoses on Cervical Spine Motion: A Standardized Radiographic 065
  Evaluation of an Automatic Knee Locking Mechanism for a Knee Ankle Orthoses 075
  Evaluation of the Potential Therapeutic Effects of Applying Electrical Stimulation to the 140
  Externally Controlled Modification of the Impaired Ambulation of Hemiparetic Patients by 130
  Functional Achievement Evaluation RIC Tenodesis Splint 375
  Functional, Social and Vocational Assessment of Surviving Persons with Documented 174
  Mechanical and Functional Evaluation Various Designs of Knee Ankle Orthoses used in 074
  Orthotics and Prosthetics Design Improvements 024
  Pathomechanics of Upper Limbs as a Basis for Improved Prosthetic and Orthotic Design 033
  Psychological Consequences of a Change in Lower Extremity Orthotics 126
  Quantification of the Biomechanical Function of Various Designs and Adjustments of Ankle 101
  Research Developments of Lower Extremity Orthotic Systems for Patients with Various 124
  Short Leg Bracing in Selected Cases of Crouch Gait 093
  Technology Assessment: Human Rehabilitation Techniques 403
OSSIFICANS – see BONE DISORDER
  MINERAL
OSSIFICATION – see BONE DISORDER
  MINERAL
OSTEOARTHRITIS – see ARTHRITIS, BONE
  JOINT
OSTEOMYELITIS – see BONE DISORDER
OSTEOPOROSIS – see BONE DISORDER
OUTCOME STUDIES – see REHABILITATION GOAL
OXYGEN
  Application of Ozone to Infected Wounds and Pressure Sores and in the Managemen 019
  Energy Expenditures while Performing Normal Street Walking – A Comprehensive Stud 366
  Physiologic Responses of Hemiparetic Patients to Specific Exercise Stress 168
  Technology Assessment: Human Rehabilitation Techniques 403
OXYGEN CONSUMPTION – see ENERGY
  OXYGEN
OXYGENATION HYPERBARIC – see OXYGEN
  RESPIRATION
OZONE – see OXYGEN

P
PACEMAKER – see CARDIAC
PAIN
  Preliminary Investigation of Micrographic Viewer for use by Disabled Persons 371
  Comparison of Subjective Feelings of Pain with Impressions Obtained by Professional Person 094
  Followup Study of Patients Treated in the Pain Treatment Program Physical Medicine 062
  Heliomagnestat Study No. 2 – Heliomagnestat (TM) in Pain States – Long-Term Study 148
  Heliomagnestat Study No. 3 – The Heliomagnestat (TM) in Pain: A Reinforcer in Contingency 153
  Heliomagnestat Study No. 4 – The Heliomagnestat (TM) in Back Pain: A Bio-Engineering 154
  Operant Conditioning Methods in Management of Chronic Pain 079
  Pain in Spinal Cord Injury 370
  Semantic Analysis of Clinical Pain 102
  Technology Assessment: Human Rehabilitation Techniques 403
  Voluntary Control of Autonomic Processes Using Biofeedback and Reinforcement Procedures 056
PALSY – see also BELL'S PALSY
  PARKINSON'S DISEASE
  Basal Ganglia Influences on Axial and Proximal Musculature 069

Employment Potential of the Severely Disabled Young Adult 157
Engineering Analysis and Evaluation of a new Radial Palsy Splint 169
Head and Eye Position Training with a Visually Monitored Task 085
Health Services for Developmentally Disabled Adults 376
Re-evaluation of Sensory Testing in Neurological Patients 163
Short leg Bracing in Selected Cases of Crouch Gait 093
Technology Assessment: Human Rehabilitation Techniques 403
Use of Motor Unit Potentials as a Measure of Neuromuscular Integrity 162

PANCREAS – see also DIGESTIVE SYSTEM
HORMONE
Appropriate Entry Level jobs and Sheltered Workshop Tasks for the Less Educated, Seve 147
Cybernetic Study to Control Spinal Reflex Activity in Spinal Cord Injured Patients 129
Electromyographic Findings in the Upper and in the Lower Motor Neuron Diseases: A Differ 355
Energy Expenditures while Performing Normal Street Walking – A Comprehensive Study u 366
Engineering Analysis and Evaluation of a new Radial Palsy Splint 169
Evaluation of Long-Term Urinary Sterilization in Catheter-Free Paraplegics 362
Evaluation of the Potential Therapeutic Effects of Applying Electrical Stimulation to the 140
Externally Controlled Modification of the Impaired Ambulation of Hemiparetic Patients by 130
Feedback Control System for the Paralyzed 037
Functional, Social and Vocational Assessment of Surviving Persons with Documented 174
H-Reflex as an Indicator of Spinal Center Integrity 357
Quantitative Studies of Muscular Strength and Muscular Work 050
Research Developments of Lower Extremity Orthotic Systems for Patients with Various F 124
Studies of Urologic Function in Patients Following Spinal Cord Injuries 045
Technology Assessment: Human Rehabilitation Techniques 403

PARALYTIC BRACHIAL NEURITIS – see NERVE DISORDER
PARALYSIS

PARAPLEGIA – see also PARALYSIS
Assessment and Evaluation of Home Health Team Activities 372
Atlas of Vocational Histories of Persons with Spinal Cord Injuries 054
Bibliography of Psychosocial, Vocational, and Sexual Aspects of Spinal Cord Injury 058
Clinical Assessment of Psychological Adjustment to Spinal Cord Injury 365
Development and Evaluation of Automatic Warning Device to help Prevent Pressure Ulc 359
Effect of Disodium Etidronate (Diphosphonate) on Acute Osteoporosis 354
Effect of Disodium Etidronate on the Recurrence of Ectopic Calcification Following Surg 361
Electromyographic Findings in the Upper and in the Lower Motor Neuron Diseases: A Differ 355
Energy Expenditures While Performing Normal Street Walking – A Comprehensive Study 366
Evaluation of Long-Term Urinary Sterilization in Catheter-Free Paraplegics 362
Evaluation of Wheelchair Designs for Quadriplegic Patients 110
H-Reflex as an Indicator of Spinal Center Integrity 357
Importance of Central and Peripheral Temperatures in Maintaining Euthermia in Patients 364
Improvement of Function of Spastic and Stroke Patients by means of Biofeedback 158
Localization of Urinary Tract Infection by Identifying Bacterial Antibody-Coating with 363
Longitudinal Study of Quadriplegic Young Adults in a Cooperative Self-Support Residen 133
Long-Term Follow-up Studies of Patients with Spinal Cord Injury who Became Catheter Fr 369
Mechanical and Functional Evaluation Various Designs of Knee Ankle Orthoses Used in 074
Natural History of Deep-Vein Thrombosis in the Spinal Cord Injured 386
Overcoming Disincentives to the Rehabilitation of SSI and SSDI Beneficiaries 367
Pain in Spinal Cord Injury 370
Preliminary Investigation of Micrographic Viewer for use by Disabled Persons 371
Renal Scintillation Camera Studies as a Method of Following Renal Function and Urolog 368
Scientific and Clinical Testing of New Experimental Drugs 161
Study of Residential Environments for Physically Disabled Young Adults in Houston, Texa 134
Studies of Urologic Function in Patients Following Spinal Cord Injuries 045
Technology Assessment: Human Rehabilitation Techniques 403
Voluntary Control of Autonomic Processes Using Biofeedback and Reinforcement Proced 056

PARAPROFESSIONAL – see ALLIED HEALTH PERSONNEL
PARENT
Establishment of the High-Risk Population Laboratory 257
Information Transmission in the Mother-Child Dyad 242
Personal-Social Functioning of Cooperative Work-Study students: Parents' Perspectives 394
Study of the Development and Change of Attitudes of Medical Students Throughout the 040
PARKINSON'S DISEASE – see also NERVE DISORDER
Basil Ganglia Control of Postural Adjustment 084
Basal Ganglia Influences on Axial and Proximal Musculature 069
Functional Distinction Between Neural Systems Involved in the Disabilities of Parkinson's 115
PARTIAL WEIGHT BEARING – see ORTHOSIS and PROSTHESIS
PATELLAR TENDON BRACE – see ORTHOSIS and PROSTHESIS
PATHOGENIC BACTERIA
Localization of Urinary Tract Infection by Identifying Bacterial Antibody-coating with 363
Prevention of Urinary Tract Infection in Spinal Cord Injury 385
Studies of Urologic Function in Patients Following Spinal Cord Injuries 045
PATIENT CARE – see HEALTH CARE
PATIENT DATA – see CASE FINDING, DATA COLLECTION
MEDICAL RECORD
PATIENT EDUCATION – see EDUCATION
PATIENT EVALUATION STUDY – see EVALUATION
PATIENT RECORD – see MEDICAL RECORD
PATTERN PROBABILITY MODEL – see FACTOR ANALYSIS and MODEL
PEABODY PICTURE VOCABULARY TEST – see PSYCHOMETRICS
PEER – GROUP LIVING – see GROUP HOME
PEMBERTON STANDING BRACE – see ORTHOSIS, PROSTHESIS
PERCEPTION
Assessing Vocational Aptitudes Using a Task Performance Rating Scale 407
Development of Standards and Principles for Visual Displays for Deaf Persons. The Vis 330
Diagnosis and Remediation of Deficits in Visual Information Processing and Verbal Abst 035
Establishment of Normal Standards of the Spokes Test 172
Factors Underlying Successful Adjustment of the Retarded Released from Institutions 400
Functional Skills Remediation in Hemiplegia Assessment Model for Eye-Hand Skills 005
Motor Control and its Relationship to Functional Activities 202
Remediation of Untreated Impairments 006
Response Oriented Sensory Aid for Assessment and Treatment of Oculomotor Dysfunc 197
Study of Cortical Organization Using Visual and Somatosensory Evoked Potentials 217
Towards a Placement System Empirically Established Through Criterion-Group Method: 312
Visual System Disorders and Functional Correlates 200
PERCEPTUAL MOTOR TASKS – see EVALUATION, PERCEPTION
PERFORMANCE
Development of a General Purpose Vocational Assessment Technique 388
Differential Treatment of Functional Disabilities in Work Adjustment Programming 413
Effects of Special Olympics Participation on Retarded Children, Families, and Commu 401
Employment Potential of the Severely Disabled Young Adult 157
Evaluation of Halfway House Training Programs for the Mentally Retarded 390
Extending Rehabilitation Services to the Multiply Handicapped 402
Factors Underlying Successful Adjustment of the Retarded Released from Institutions 400
Functional Achievement Evaluation Ric Tenodesis Splint 375
Functional, Social and Vocational Assessment of Surviving Persons with Documented 174
Predicting Rate of Acquisition and Production of Complex Industrial Tasks by Institutionali 322
Process and Outcomes of Vocational Evaluation Services 412
Quantitative Studies of Muscular Strength and Muscular Work 050
Scientific and Clinical Testing of new Experimental Drugs 161
Technology Assessment: Human Rehabilitation Techniques 403
PERIODIC LUNG EXPANSION – see RESPIRATION
PERSONAL ACHIEVEMENT SKILLS – see BEHAVIOR MODIFICATION

PERSONAL ADJUSTMENT – see BEHAVIOR
PERSONAL ADJUSTMENT TRAINING – see TRAINING
PERSONAL/SOCIAL ADJUSTMENT – see BEHAVIOR
CULTURAL-FAMILIAL ADJUSTMENT
PERSONALITY
- Clinical Assessment of Psychological Adjustment to Spinal Cord Injury 365
- Cluster Analysis of Personality Characteristics of Rehabilitation Clients 281
- Comprehensive Evaluation of the Relationship Between Disability and Personality Functic 289
- Effects of Vocational Evaluation on Vocational Rehabilitation 309
- Homogeneous Sub-Scales for the Mini-Mult 272
- Study of the Development and Change of Attitudes of Medical Students Throughout the 040
- Towards a Placement System Empirically Established Through Criterion-Group Method: 312

PERSONNEL – see also ALLIED HEALTH PERSONNEL
- Brown University-VR-CHIP-RT-7 Program 189
- Development of a Competency-Based Staff Development Program for Vocational Evalu 416
- Process and Outcome in Cooperative School Programs in Texas 404
- Rehabilitation Policy Studies Part II Quality Assurance 039
- Supervision in Vocational Rehabilitation 326
- Survey of Staff Development Activities in State Rehabilitation Agencies 283
- Use of the Work Environment Scale to Describe a Rehabilitation Research and Training Ce 274

PHARMACOLOGY – see DRUG THERAPY
PHENOL TREATMENT – see DRUG THERAPY
PHONETICS – see SPEECH
PHOSPHATE – see BIOCHEMICAL
PHYSICAL ACTIVITY
- Assessment of the Effect of Pacing on Quadriceps Strengthening 072
- Controlled Assessment of the Effect of Submaximal Exercise in Muscular Dystrophy 070
- Clinical Assessment of Psychological Adjustment to Spinal Cord Injury 365
- Development and Evaluation of a Self-Instructional Physical Fitness Training Program for Sp 293
- Development and Evaluation of a Systematic Physical Fitness Training Program for 278
- Effects of Special Olympics Participation on Retarded Children, Families, and Comm 401
- Energy Expenditures while Performing Normal Street Walking – A Comprehensive Study 366
- Engineering Analysis and Evaluation of a new Radial Palsy Splint 169
- Electrocardiographic Monitoring with Telementry During Physical Therapy 014
- Evaluation of an Automated Training System for Wheelchair Pushups 051
- Evaluation of Exercise after Myocardial Infarction National Exercise and Heart Disease Proj 155
- Exercise Prescription in the Hospital 350
- Fundamental Study of Human Locomotion 190
- Physiologic Responses of Hemiparetic Patients to Specific Exercise Stress 168
- Preliminary Investigation of Micrographic Viewer for use by Disabled Persons 371
- Technology Assessment: Human Rehabilitation Techniques 403

PHYSICAL FITNESS PROGRAM – see PHYSICAL ACTIVITY
PHYSICALLY DISABLED
- Clinical Assessment of Psychological Adjustment to Spinal Cord Injury 365
- Community-Based Growth Group for Disabled Persons 044
- Comprehensive Evaluation of the Relationship Between Disability and Personality Function 289
- Development and Evaluation of a Self-Instructional Physical Fitness Training Program for Sp 293
- Development of a Model Demonstration Rehabilitation Service 203
- Energy Expenditures while Performing Normal Street Walking – A Comprehensive Study 366
- Functional Achievement Evaluation RIC
- Functional, Social and Vocational Assessment of Surviving Persons with Documented 174
- Implications of the Socia-Cultural Background of Clients to Rehabilitation Personnel 159
- Incorporation of a Lexan Check Socket into a Definitive Patellar Tendon Bearing Prosth 114
- Predictor Feedback Technology for Electromyographic Control of Prosthetic and Orth 173
- Pressure Ulcer Prediction and Prevention: A New Procedure 374
- Prevention of Urinary Tract Infection in Spinal Cord Injury 385

Reducing Public Barriers of the Severely Handicapped 377
Sexual Function in Physical Disability 041
Study of the Development and Change of Attitudes of Medical Students Throughout the 040
Studies of Urologic Function in Patients Following Spinal Cord Injuries 045
Survey of Comprehensive Medical Rehabilitation Centers Serving the Most Severely 378
Technology Assessment: Human Rehabilitation Techniques 403
Towards a Placement System Empirically Established through Criterion-Group Method: 312
Vocational Follow-Up of the Physically Restored Unemployed 387

PHYSICAL MEDICINE
Clinical Classification and Functional Prediction: A Study of the Stroke Population 205
Effective Training in Rehabilitation Medicine in New Medical School Curricula 358
Energy Expenditures while Performing Normal Street Walking – A Comprehensive Study us 366
Importance of Central and Peripheral Temperatures in Maintaining Euthermia in Patients 364
Studies of Urologic Function in Patients Following Spinal Cord Injuries 045
Study of the Development and Change of Attitudes of Medical Students Throughout the t 040
Technology Assessment: Human Rehabilitation Techniques 403

PHYSICAL THERAPY
Assessment and Evaluation of Home Health Team Activities 372
Clinical Classification and Functional Prediction: A Study of the Stroke Population 205
Cognitive Assist in Motor Learning 156
Effect of Postural Drainage on Airway Obstruction 224
Effects of Specific Cutaneous Cold Stimulation on Motor Control in Cat and Man 150
Electrocardiographic Monitoring with Telementry During Physical Therapy 014
Evaluation of an Automated Training System for Wheelchair Pushups 051
Evaluation of the Feasibility of a Twelve Week Physiologically Paced Conditioning Prog 183
Exercise and Lipid Profile in Ischemic Heart Disease 137
Technology Assessment: Human Rehabilitation Techniques 403

PHYSICAL TRAINING – see PHYSICAL ACTIVITY

PHYSIOLOGY
Assessment of Hypoxia and Reduced Ventilatory Drive in Pulmonary Disability 227
Early Adjustment to Steady and Unsteady Exercise in Patients with Cardiopulmonary Disab 232
Energy Expenditures While Performing Normal Street Walking – A Comprehensive Study 366
Evaluation of the Feasibility of a Twelve Week Physiologically Paced Conditioning Prog 183
Re-Evaluation of Sensory Testing in Neurological Patients 163
Studies of Urologic Function in Patients Following Spinal Cord Injuries 045
Study of Cortical Organization Using Visual and Somatosensory Evoked Potentials 217
Use of Motor Unit Potentials as a Measure of Neuromuscular Integrity 162

PICTURE MORPHOLOGY – see SPEECH

PLACEMENT
Atlas of Vocational Histories of Persons with Spinal Cord Injuries 054
Community Group Homes for the Developmentally Disabled 318
Crisis Intervention Rehabilitation Applied Research Program for the Severely Developmen 258
Development of a General Purpose Vocational Assessment Technique 388
Development of a Measurement Tool for Placements in Care Facilities 066
Explore Means of Utilizing the Severely Disabled Homebound to Pool Rehabilitation Ser 209
Factors Underlying Successful Adjustment of the Retarded Released from Institutions 400
Follow-Along Study of Clients Returned for Service to a State Rehabilitation Agency 170
Functional, Social and Vocational Assessment of Surviving Persons with Documented 174
Job Development and Enhanced Productivity for Severely Disabled 218
Measure of Suitability of Placement 280
Process and Outcome in Cooperative School Programs in Texas 404
Towards a Placement System Empirically Established Through Criterion-Group Method: 312

PLACEMENT SUITABILITY – see PLACEMENT

PLASTIC LAMINATE – see ORTHOSIS
PROSTHESIS

PLASTIC TENODESIS SPLINT-see ORTHOSIS
PROSTHESIS

PNEUMONOCONIOSIS – see RESPIRATORY DISORDER

POLIOMYELITIS
    Motor Unit Composition and Voluntary Force in Neuromuscular Disease 201
    Use of Periodic Lung Expansion for the Facilitation and Rehabilitation and Prevention 004
POLYMYELITIS – see MUSCULAR DISORDER
POLYNEPHRITIS – see URINARY DISORDER
POLYNEURITIS – see NERVE DISORDER
POPULATION STUDY – see CENSUS
POSTURE
    Footwear and Posture: Phases I-V 106
    Postural Control in Neurosensory Disability: Functional Implications and Therapeutic 191
    Technology Assessment: Human Rehabilitation Techniques 403
POTASSIUM – see MINERAL
POVERTY – see DISADVANTAGED
    SOCIOECONOMIC CLASS
PRESCHOOL EDUCATION – see EDUCATION
PRESSURE SORE – see also SKIN DISORDER
    ULCER
    Application of Ozone to Infected Wounds and Pressure Sores and in the Managemen 019
    Development and Evaluation of Automatic Warning Device to help Prevent Pressure Ulc 359
    Evaluation of Various Seat Cushions Designed to Prevent Pressure Sores 081
    Investigation of Decubitus Ulcer as Manifestation of Psychosocial Problem 057
    Modular Hyperbaric Oxygen Treatment of Pressure Sores and Traumatic Skin Lesions of 032
    Pressure Ulcer Prediction and Prevention: A New Procedure 374
    Studies of Urologic Function in Patients Following Spinal Cord Injuries 045
    Technology Assessment: Human Rehabilitation Techniques 403
    Topical Hyperbaric Oxygen Treatment of Pressure Sores and Certain Skin Ulcerations 020
    Variable Inclination Mattress 008
    Zinc Sulphate in the Treatment of Various Skin Disorders 021
PRETRAINING – see EDUCATION
PREVENTIVE REHABILITATION – see REHABILITATION PROGRAM
PREVENTIVE TREATMENT – see THERAPY
PREVENTIVE THERAPY – see THERAPY
PREVOCATIONAL EVALUATION – see EVALUATION
    WORK

PROBLEM ORIENTED CHARTING
    Development of a Systematic Problem Solving Approach to the Practice of Rehabilit 042
PROBLEM-SOLVING
    Development of a Systematic Problem Solving Approach to the Practice of Rehabilit 042
    Oddity Discrimination in Young Children 245
    Supervision in Vocational Rehabilitation 326
PROBLEM YOUTH – see DELINQUENCY
    YOUTH
PROCESSOR – see also MAN-MACHINE SYSTEM
    Comparative Clinical Evaluation of Several EMG Processing Techniques 164
PRODUCTION MODEL – see MODEL
PROFESSIONAL PERSONNEL TRAINING – see PERSONNEL
    TRAINING
PROFILE ANALYSIS TECHNIQUE – see EVALUATION
PROGNOSIS
    Clinical Assessment of Psychological Adjustment to Spinal Cord Injury 365
    Functional, Social and Vocational Assessment of Surviving Persons with Documented 174
    Re-Evaluation of Sensory Testing in Neurological Patients 163
    Study of Cortical Organization Using Visual and Somatosensory Evoked Potentials 217
    Use of Motor Unit Potentials as a Measure of Neuromuscular Integrity 162
PROGRAM EVALUATION – see EVALUATION
PROGRAM PLANNING – see REHABILITATION PROGRAM

PROGRAMMED LEARNING – see LEARNING
PROGRAMMING – see INFORMATION ACTIVITY
LEARNING
PROSTHESIS
Comparative Clinical Evaluation of Several EMG Processing Techniques 164
Evaluation of an Automatic Knee Locking Mechanism for a Knee Ankle Orthoses 075
Incorporation of a Lexan Check Socket into a Definitive Patellar Tendon Bearing Prosth 114
Pathomechanics of Upper Limbs as a Basis for Improved Prosthetic and Orthotic Desi 033
Predictor Feedback Technology for Electromyographic Control of Prosthetic and Orth 173
Orthotics and Prosthetics Design Improvements 024
Technology Assessment: Human Rehabilitation Techniques 403
PROTEIN – see BIOCHEMICAL
PSYCHO-BEHAVIORAL TEST BATTERY – see PSYCHOMETRICS
PSYCHOGENIC DISORDER
Role of Family in Institutional Rehabilitation of Clients with Behavioral and Physical Disabi 220
PSYCHOLOGICAL TEST – see PSYCHOMETRICS
PSYCHOLOGY
Clinical Assessment of Psychological Adjustment to Spinal Cord Injury 365
Crisis Intervention Rehabilitation Applied Research Program for the Severely Developmen 258
Evaluation of the Feasibility of a Twelve Week Physiologically Paced Conditioning Prog 183
Follow-Along Study of Clients Returned for Service to a State Rehabilitation Agency 170
Functional Skills Remediation in Hemiplegia Assessment Model for Eye-Hand Skills 005
Pain in Spinal Cord Injury 370
Preparation of a Training Manual Psychology of Deafness 267
Reducing Public Barriers of the Severely Handicapped 377
Remediation of Untreated Impairments 006
Role of Family in Institutional Rehabilitation of Clients with Behavioral and Physical Disabi 220
Technology Assessment: Human Rehabilitation Techniques 403
PSYCHOMETRICS
Development of a Model for Evaluating the Relationship Between EMR Work/Study Progr 317
Effects of Vocational Evaluation Programming on the Vocational Development of Rural 409
Homogeneous Sub-Scales for the Mini-Mult 272
Investigation of the Mentally Retarded Clients both Rehabilitated and Nonrehabilitate 256
Predicting Rate of Acquisition and Production of Complex Industrial Tasks by Institutional 322
Process and Outcomes of Vocational Evaluation Services 412
PSYCHOMOTOR
Comparative Clinical Evaluation of Several EMG Processing Techniques 164
Functional Skills Remediation in Hemiplegia Assessment Model for Eye-Hand Skills 005
Predictor Feedback Technology for Electromyographic Control of Prosthetic and Orth 173
PSYCHOPATHOLOGY ASSESSMENT DEVICE – see EVALUATION
PSYCHOSOCIAL
Clinical Component: Medical Complications of Patients with end Stage Renal Disease 223
Cluster Analysis of Personality Characteristics of Rehabilitation Clients 281
Demonstration of Benefits of Early Identification of Psychosocial Problems and Early 029
Evaluation of Exercise After Myocardial Infarction National Exercise and Heart Disease 155
Family Factors in the Recurrence and Maintenance of Alcoholism and Other Chronic 214
Handbook of Behavior Management Procedures for Psychsocial Problems in Rehabilit 260
Information Transmission in the Mother-Child Dyad 242
Live Adjustment Post Myocardial Infarction Defining Predictive Variables 213
Pain in Spinal Cord Injury 370
Reducing Public Barriers of the Severely Handicapped 377
Research on the Psychosocial and Vocational Adjustment of Spinal 285
Role of Family in Institutional Rehabilitation of Clients with Behavioral and Physical Dis 220
Sexual Function in Physical Disability 041
Study of Emotional Forces in Psychogenic Asthma 216
Study of the Development and Change of Attitudes of Medical Students Throughout 040
Systematic Psychosocial Vocational Treatment Strategies in Vocational Rehabilitatio 300

PSYCHOSOCIAL ASPECTS OF REHABILITATION
- Bibliography of Psychosocial, Vocational and Sexual Aspects of Spinal Cord Injury 058
- Community-Based Maintenance Care for the Long-Term Patient (Planning Grant to De 166
- Community Group Homes for the Developmentally Disabled 318
- Crisis Intervention Rehabilitation Applied Research Program for the Severely Develop 258
- Demonstration of Benefits of Early Identification of Psychosocial Problems and Early 029
- Development and Evaluation of a Systematic Physical Fitness Training Program for 278
- Development of a Training Manual of Psychological Aspects of Disability 287
- Effects of Vocational Evaluation on Vocational Rehabilitation 309
- Family Factors in the Recurrence and Maintenance of Alcoholism and Other Chronic 214
- Family Unit as an Untapped Rehabilitation Force 306
- Follow-Along Study of Clients Returned for Service to a State Rehabilitation Agency 170
- Follow-up Study of the Psychological, Social and Vocational Adjustment of Spinal 053
- Handbook of Behavior Management Procedures for Psychsocial Problems in Rehabilit 260
- Identification of Work Reinforcers Found in Sheltered Workshops and their Relationship 410
- Implications of the Socio-Cultural Background of Clients to Rehabilitational Personnel 159
- Investigation of Decubitus Ulcer as Manifestation of Psychosocial Problem 057
- Live Adjustment Post Myocardial Infarction Defining Predictive Variables 213
- Longitudinal Analysis of Patient Behavior 139
- Pain in Spinal Cord Injury 370
- Rehabilitation Policy Studies Part II: Quality Assurance 039
- Research on the Psychosocial and Vocational Adjustment of Spinal Cord Injured Clie 285
- Role of Family in Institutional Rehabilitation of Clients with Behavioral and Physical Dis 220
- Sexual Function in Physical Disability 041
- Study of Emotional Forces in Psychogenic Asthma 216
- Technology Assessment: Human Relations Techniques 403
- Towards a Placement System Empiricallly Established Through Criterion-Group Method: 312

PSYCHOTHERAPY
- Live Adjustment Post Myocardial Infarction Defining Predictive Variables 213
- Technology Assessment: Human Rehabilitation Techniques 403
- Study of the Development and Change of Attitudes of Medical Students Throughout 040
- Study of Emotional Forces in Psychogenic Asthma 216

PUBLIC ASSISTANCE – see FINANCING
WELFARE

PUBLIC OFFENDER – see also DELINQUENCY

PULMONARY DISEASE – see RESPIRATORY DISORDER

PULMONARY EMBOLIZATION – see RESPIRATION
THERAPY

PULMONARY FUNCTION – see RESPIRATION

PULMONARY OXYGEN TOXICITY – see RESPIRATORY DISORDER

PULMONARY REHABILITATION
- Effect of Postual Drainage on Airway Obstruction 224
- Technology Assessment: Human Rehabilitation Techniques 403

PUPIL-TEACHER INTERACTION
- Evaluation of Halfway House Training Programs for the Mentally Retarded 390
- Study of the Development and Change of Attitudes of Medical Students Throughout 040

Q

QUADRIPLEGIA – see also PARALYSIS
- Assessment and Evaluation of Home Health Team Activities 372
- Atlas of Vocational Histories of Persons with Spinal Cord Injuries 054
- Bibliography of Psychosocial, Vocational, and Sexual Aspects of Spinal Cord Injury 058
- Development and Evaluation of Automatic Warning Device to Help Prevent Pressure Ulc 359

Development of Transfer Devices for High Quadriplegic Patients 038
Effect of Disodium Etidronate (Diphosphonate) on Acute Osteoporosis 354
Effect of Disodium Etidronate on the Recurrence of Ectopic Calcification Following Sur 361
Electromyographic Findings in the Upper and in the Lower Motor Neuron Diseases: A 355
Energy Expenditures While Performing Normal Street Walking – A Comprehensive Study 366
Evaluation of Various Electronic Devices to Increase Mobility and Independence of Very 028
Evaluation of Wheelchair Designs for Quadriplegic Patients 110
Feedback Control System for the Paralyzed 037
Functional Achievement Evaluation RIC Tenodesis Splint 375
Further Studies of the Pathophysiology of Spasticity 192
H-Reflex as an Indicator of Spinal Center Integrity 357
Importance of Central and Peripheral Temperatures in Maintaining Euthermia in Patients 364
Localization of Urinary Tract Infection by Identifying Bacterial Antibody-Coating with 363
Longitudinal Study of Quadriplegic Young Adults in [illegible] Cooperative Self-Support Reside 133
Natural History of Deep-Vein Thrombosis in the Spinal Cord Injured 386
Overcoming Disincentives to the Rehabilitation of SSI and SSDI Beneficiaries 367
Pain in Spinal Cord Injury 370
Preliminary Investigation of Micrographic Viewer for Use by Disabled Persons 371
Pressure Ulcer Prediction and Prevention: A New Procedure 374
Renal Scintillation Camera Studies as a Method of Following Renal Function and Urolo 368
Respiratory Function of Quadriplegic Individuals Influenced by Glossopharyngeal Breat 118
Study of Residential Environments for Physically Disabled Young Adults in Houston, Tex 134
Technology Assessment: Human Rehabilitation Techniques 403
Use of Periodic Lung Expansion for the Facilitation and Rehabilitation and Prevention 004

QUALITY ASSURANCE
Quality Assurance in Rehabilitation 349
Rehabilitation Policy Studies Part II: Quality Assurance 039
Validity and Reliability of Health Accounting Method of Quality Assurance in a Rehabilita 059

QUALITY OF CARE – see QUALITY ASSURANCE

QUESTIONNAIRE
Effects of Special Olympics Participation on Retarded Children, Families, and Commu 401
Evaluation of Long-Term Urinary Sterilization in Catheter-Free Paraplegics 362
Feedback Systems for Insuring Quality in Facility Based Services 411
Follow-up Study of Rehabilitation Short-Term Training 325
Functional, Social and Vocational Assessment of Surviving Persons with Documented 174
Investigation of the Mentally Retarded Clients Both Rehabilitated and Nonrehabilitated 256
Long-Term Follow-up Studies of Patients with Spinal Cord Injury who Became Catheter Fr 369
Pain in Spinal Cord Injury 370
Research Needs in Vocational Rehabilitation 327
Supervision in Vocational Rehabilitation 326
Survey of Comprehensive Medical Rehabilitation Centers Serving the Most Severely 378
Vocational Follow-up of the Physically Restored Unemployed 387

R

RADIAL NERVE PALSY
Engineering Analysis and Evaluation of a New Radial Palsy Splint 169

RADIAL PALSY SPLINT
Engineering Analysis and Evaluation of a New Radial Palsy Splint 169

RADIATION
Evaluation of Advanced Designs of Microwave Diathermy Applicators 068
Mapping of Microwave Fields Surrounding Human Subjects Under Diathermy Treatm 120
Program on the Quantitation of the Effects of Electromagnetic Energy on Human Tiss 097
Technology Assessment: Human Rehabilitation Techniques 403

RADIO-CONTROLLED EQUIPMENT – see EQUIPMENT
REHABILITATION DEVICE

RADIOGRAPHY
- Applications of the Evoked Electrospinogram 193
- Studies of Urologic Function in Patients Following Spinal Cord Injuries 045
- Technology Assessment: Human Rehabilitation Techniques 403

RANGE OF MOTION – see MOVEMENT

RATING SCALE
- Conceptual Model of Planning and Evaluation of Rehabilitation Services 383
- Effects of Vocational Evaluation Programming on the Vocational Development of Rural H 409
- Functional, Social and Vocational Assessment of Surviving Persons With Documented 174
- Modification of Speech Patterns of Normal and Dysarthric Speakers as a Function of Four R 116
- Process and Outcome in Cooperative School Programs in Texas 404
- Rehabilitation Policy Studies Part II: Quality Assurance 039
- Survey of Comprehensive Medical Rehabilitation Centers Serving the Most Severely 378

RAYNAUD'S DISEASE
- Controlled Study of the Use of Temperature Feedback for the Treatment of Raynaud's Dise 107
- Voluntary Control of Autonomic Processes Using Biofeedback and Reinforcement Proced 056

RECORD – see MEDICAL RECORD

RECREATION
- Effects of Special Olympics Participation on Retarded Children, Families, and Comm 401
- Evaluation of Various Electronic Devices to Increase Mobility and Independence of Very 028
- Factors Underlying Successful Adjustment of the Retarded Released from Institutions 400
- Functional, Social and Vocational Assessment of Surviving Persons with Documented 174
- Research Needs in Vocational Rehabilitation 327
- Technology Assessment: Human Rehabilitation Techniques 403

RED CROSS
- Crisis Intervention Rehabilitation Applied Research Program for the Severely Development 258

REFERRAL PROGRAM – see REHABILITATION PROGRAM

REFLEX – see NERVE STUDY

REFLUX – see URINARY DISORDER

REGIONAL CENTER FOR SPINAL CORD INJURY – see SPINAL CORD INJURY

REHABILITATION AGENCY – see AGENCY

REHABILITATION AGENCY PERSONNEL – see PERSONNEL

REHABILITATION CAREER – see CAREER

REHABILITATION CENTER
- Conceptual Model of Planning and Evaluation of Rehabilitation Services 383
- Crisis Intervention Rehabilitation Applied Research Program for the Severely Development 258
- Effects of Vocational Evaluation on Vocational Rehabilitation 309
- Evaluation of the Relationship of Self-Care Outcomes to Care in the Acute Hospital, th 055
- Identification of Factors Affecting Behavioral Competency in a Comprehensive Rehabilita 302
- Investigation of the Mentally Retarded Clients both Rehabilitated and Nonrehabilitated 256
- Survey of Comprehensive Medical Rehabilitation Centers Serving the Most Severely 378
- Systematic Psychosocial Vocational Treatment Strategies in Vocational Rehabilitation 300
- Use of the Work Environment Scale to Describe a Rehabilitation Research and Training Cent 274

REHABILITATION COUNSELING – see COUNSELING

REHABILITATION DEVICE
- Application of Dynamic Palatography in Organic Speech Disorders 195
- Automated Nerve Conduction Velocity Device 109
- Comparative Clinical Evaluation of Several EMG Processing Techniques 164
- Crisis Intervention Rehabilitation Applied Research Program for the Severely Developmenta 258
- Development and Evaluation of Automatic Warning Device to Help Prevent Pressure Ulcers 359
- Development of a System for Determination of Frequency and Volume of Urination in Patie 356
- Environmental Enhancement Through Adaptive Aids for the Severely Disabled 089
- Establishment of the High-Risk Population Laboratory 257
- Evaluation of a Sonic Urinimeter for Blind Diabetics 149
- Evaluation of Methods and Aids Used in Gait Training 073

Functional Achievement Evaluation RIC Tenodesis Splint 375
Predictor Feedback Technology for Electromyographic Control of Prosthetic and Orth 173
Preliminary Investigation of Micrographic Viewer for Use by Disabled Persons 371
Technology Assessment: Human Rehabilitation Techniques 403
REHABILITATION ENVIRONMENT – see ENVIRONMENT
REHABILITATION FACILITY – see AGENCY, INSTITUTION
HEALTH CARE
EXTENDED CARE FACILITY
REHABILIATION GOAL
Analysis of Public Assistance/Social Services for the Mentally Retarded 324
Application of Dynamic Palatography in Organic Speech Disorders 195
Application of Personal Achievement Skills to Personal Adjustment Training for the Blin 292
Clinical Assessment of Psychological Adjustment to Spinal Cord Injury 365
Clinical Classification and Functional Prediction: A Study of the Stroke Population 205
Comprehensive Evaluation of the Relationship Between Disability and Personality Functio 289
Contributions of Personal Achievement Skills to Work Adjustment Training 279
Crisis Intervention Rehabilitation Applied Research Program for the Severely Developmen 258
Developing an Empirically Based Training Program in Mental Retardation 397
Development and Evaluation of an Interpersonal Skills Training Package 288
Development and Evaluation of a Set of Systematic Training Units to Increase or Decr 298
Development of an Improved System for Measuring Client Outcome 290
Dimensions of Rehabilitation Outcome: A Factor Analystic Study of Several Measures of C 284
Evaluation of the RIDAC (Rehabilitation Initial Diagnosis and Assessment for Clients) Proje 291
Facilitative Staff Attitudes Toward Disabled Persons 261
Facilitative Case Management in Rehabilitation 271
Family Unit as an Untapped Rehabilitation Force 306
Handbook of Behavior Management Procedures for Psychsocial Problems in Rehabilit 260
Measure of Suitability of Placement 280
Pattern-Probability Model for Predicting Client Outcome 270
Reducing Public Barriers of the Severely Handicapped 377
Rehabilitation Follow-up Program 380
Rehabilitation of the End-Stage Renal Disease Client – Selected Readings 295
Rehabilitation Policy Studies Part II: Quality Assurance 039
Rehabilitation/Public Assistance Worker Attitudes and Client Outcome 264
Research on the Psychosocial and Vocational Adjustment of Spinal Cord Injured Clie 285
Sociological Look at the Impact of Normalization 328
REHABILITATION ISSUES – see also CONSUMER INVOLVEMENT
Consumer Involvement and Policy Development Consultation: A Resource Manual for 294
REHABILITATION MANAGEMENT SYSTEM – see MANAGEMENT
REHABILITATION MEDICAL PRACTICE – see REHABILITATION PROGRAM
REHABILITATION MEDICINE/EXPOSURE – see REHABILITATION PROGRAM
REHABILITATION NEEDS – see EVALUATION
REHABILITATION OUTCOME – see REHABILITATION GOAL
REHABILITATION PERSONNEL – see PERSONNEL
REHABILITATION PLANNING – see REHABILITATION GOAL
REHABILITATION PROGRAM
REHABILITATION POLICY – see REHABILITATION PROGRAM
REHABILITATION POTENTIAL – see REHABILITATION GOAL
REHABILITATION PROGRAM
Application of Dynamic Palatography in Organic Speech Disorders 195
Assessment and Evaluation of Home Health Team Activities 372
Client, Family, School and Community Variables Related to the Educational-Rehabilit 254
Clinical Assessment of Psychological Adjustment to Spinal Cord Injury 365
Community Group Homes for the Developmentally Disabled 318
Computer Retrieval of Data for Long Range Evaluation Studies of Medical Rehabilita 180
Continuing Assessment of Programs for Preparation of Professionals to Work with Deaf Pe 331
Cost Analysis of the Rehabilitation of Severely Disabled Deaf Clients 346

Crisis Intervention Rehabilitation Applied Research Program for the Severely Developmen 258
Developing an Empirically Based Training Program in Mental Retardation 397
Development and Evaluation of a Self-Instructional Physical Fitness Training Program for S 293
Development and Evaluation of a Systematic Physical Fitness Training Program for 278
Development of Videotapes for Application in Training Rehabilitation Counselors to Work 344
Effective Training in Rehabilitation Medicine in New Medical School Curricula 113
Effective Training in Rehabilitation Medicine in New Medical School Curricula 358
Effects of Vocational Evaluation on Vocational Rehabilitation 309
Energy Expenditures While Performing Normal Street Walking — A Comprehensive Study 366
Establishment of the High-Risk Population Laboratory 257
Evaluation of a Physical, Intellectual, and Emotional Personal Adjustment Training Progr 275
Evaluation of Efficacy of Rehabilitation Programs 052
Evaluation of Halfway House Training Programs for the Mentally Retarded 390
Evaluation of the Relationship of Self-Care Outcomes to Care in the Acute Hospital, I 055
Expanded Public Assistance/Vocational Rehabilitation Service for Rural Public Assist 263
Extending Rehabilitation Services to the Multiply Handicapped 402
Factors Influencing Counselors Determination of Client Eligibility and Referral for Faci 417
Factors Influencing Vocational Rehabilitation Counselor Utilization of Vocational Evalu 408
Family Unit as an Untapped Rehabilitation Force 306
Client Vocational Needs
Feedback Systems for Insuring Quality in Facility Based Services 411
Follow-up Study of Rehabilitation Short-Term Training 325
Investigation of the Mentally Retarded Clients Both Rehabilitated and Nonrehabilitat 256
Long-Term Follow-up Studies of Patients with Spinal Cord Injury who Became Catheter 369
Model Casefinding, Counseling and Referral Program for Deaf People 332
Model State Plan Inventory 341
Multimedia Rehabilitation Resource Center Project 210
Pilot Project: Stroke in the Young 222
Process and Outcome in Cooperative School Programs in Texas 404
Program Evaluation Methods for State Vocational Rehabilitation Agencies 269
Program Evaluation — Modular Information System to Evaluate Rehabilitation 310
Project to Provide Systematic Follow-Along to Persons Medically Rehabilitated in Fall 167
Quality Assurance in Rehabilitation 349
Rehabilitation Follow-up Program 380
Method for Enhancing Accountability 031
Rehabilitation of the Rural Public Assistance Recipient at a Comprehensive Rehabilitat 262
Rehabilitation Potential of Stroke Patients as a Function of Cerebral Lesion, Visualized 219
Rehabilitation Training Materials Study 211
Review and Analysis of Drug Treatment Literature 268
Serving Deaf Rehabilitation Clients: Fundamentals of Communication 273
Simplified Model for Cost-Benefit Analysis in Rehabilitation Programs 313
Sociological Look at the Impact of Normalization 328
Statistical Collection System for a Medical Rehabilitation Facility 181
Systematic Analysis of Rehabilitation Data for Program Evaluation 308
Systematic Psychosocial Vocational Treatment Strategies in Vocational Rehabilitation 300
Technology Assessment: Human Rehabilitation Techniques 403
R-300: A Vocational Rehabilitation Profile (A Model for Assessing how Vocational 307

REHABILITATION RESEARCH – see RESEARCH PROGRAM
REHABILITATION SERVICE – see SERVICE DELIVERY
REHABILITATION SYSTEM – see REHABILITATION PROGRAM
REHABILITATION TRAINING – see TRAINING
REINFORCEMENT – see also MOTIVATION
Application of Dynamic Palatography in Organic Speech Disorders 195
Clinical Assessment of Psychological Adjustment to Spinal Cord Injury 365
Crisis Intervention Rehabilitation Applied Research Program for the Severely Development 258

Effects of Different Types of Frustrating Conditions on the Behavior of Institutionalized 252
Identification of Work Reinforcers Found in Sheltered Workshops and their Relationship 410
Sociological Look at the Impact of Normalization 328
RELAXATION – see also BEHAVIOR, STRESS
Effectiveness of EMG Muscle Relaxation Training as a Function of Feedback Mode and 108
REMEDIAL EDUCATION – see EDUCATION
LEARNING
REMOTE CONTROL DEVICE – see REHABILITATION DEVICE
RENAL – see URINARY DISORDER
REPETITIVE TASK – see LEARNING
RESEARCH PROGRAM
Crisis Intervention Rehabilitation Applied Research Program for the Severely Development 258
Effects of Vocational Evaluation on Client Vocational Awareness, Attitude and Compete 414
Evaluation of a Physical, Intellectual, and Emotional Personal Adjustment Training Progra 275
Evaluation of the Relationship of Self-Care Outcomes to Care in the Acute Hospital, th 055
Factors Underlying Successful Adjustment of the Retarded Released from Institutions 400
Functional, Social and Vocational Assessment of Surviving Persons with Documented 174
Increasing Research Utilization Through the Development of Training Packages 303
Investigation of the Mentally Retarded Clients Both Rehabilitated and Nonrehabilitate 256
Oddity Discrimination in Young Children 245
Predicting Rate of Acquisition and Production of Complex Industrial Tasks by Institutiona 322
Quantitative Studies of Muscular Strength and Muscular Work 050
Research Needs in Vocational Rehabilitation 327
Research in Upper and Lower Extremity Orthotics 177
Study of Consumer Needs, Circumstances, and Attitudes 406
Study of the Development and Change of Attitudes of Medical Students Throughout the 040
Summary of the Results of Rehabilitation Counseling Research 1955-1974 276
Supervision in Vocational Rehabilitation 326
Training Evaluation Kit 323
RESEARCH SURVEY – see RESEARCH PROGRAM
RESIDENCE – see HOUSING
RESIDENT – see PERSONNEL
RESIDENTIAL FACILITY – see also GROUP HOME
INSTITUTION
Behavioral Architecture: Ecological Designing of Facilities for the Mentally Retarded 389
Community Group Homes for the Developmentally Disabled 318
Cost Analysis and Program Budgeting of Community Residential Facilities and Rehabilit 320
Factors Underlying Successful Adjustment of the Retarded Released from Institutions 400
Longitudinal Study of Quadriplegic Young Adults in a Cooperative Self-Support Reside 133
Measuring Client Gain in Group Homes for the Retarded 321
Medical Examinations of a Selected Sample from the Study of Highland Heights, a Medi 186
Project to Document the Development of a Cooperative Group Residence for Severel 184
Sociological Look at the Impact of Normalization 328
Study of Residential Environments for Physically Disabled Young Adults in Houston, Tex 134
Technology Assessment: Human Rehabilitation Techniques 403
RESOURCE MANUAL – see HANDBOOK
RESPECT – see BEHAVIOR and EMOTION
RESPIRATION
Assessment of Hypoxia and Reduced Ventilitory Drive in Pulmonary Disability 227
Evaluation of Various Electronic Devices to Increase Mobility and Independence of Very 028
Respiratory Function of Quadriplegic Individuals Influenced by Glossopharyngeal Breat 118
Technology Assessment: Human Rehabilitation Techniques 403
RESPIRATORY DISORDER – see also CARDIOVASCULAR-RESPIRATORY DISORDERS
CHRONIC OBSTRUCTIVE PULMONARY DISEASE
Assessment of Hypoxia and Reduced Ventilitory Drive in Pulmonary Disability 227
Controlled Study of Inhalational Therapy in the Rehabilitation of Patients with Chronic 001
Effect of Environmental Factors and Geographic Location on Vocational Rehabilitation 002

Effect of Postural Drainage on Airway Obstruction 224
Electrophrenic Nerve Stimulation – A Feasibility Study 125
Factors Influencing the Right Heart Failure of Patients with Chronic Pulmonary Disease 003
Study of Emotional Forces in Psychogenic Asthma 216
Technology Assessment: Human Rehabilitation Techniques 403
Work Classification of Patients with Obstructive Pulmonary Diseases Following Rehabilit 023
RESPIRATORY SYSTEM STUDY – see RESPIRATION
RESPIRATORY THERAPY – see RESPIRATORY DISORDER
THERAPY
RETARDATE – see MENTALLY RETARDED
REVIEW – see LITERATURE SURVEY
RHEUMATIC DISEASE – see RHEUMATOID DISORDER
RHEUMATOID ARTHRITIS – see ARTHRITIS
RHEUMATOID DISORDER
RHEUMATOID DISORDER
Comparison of Two Dosage Schedules of Gold in the Treatment of Rheumatoid Arthrit 136
Value of LDH Isoenzyme Studies in Collagen Disease 064
Technology Assessment: Human Rehabilitation Techniques 403
RHEUMATOLOGY – see RHEUMATOID DISORDER
RIDAC
Effects of Vocational Evaluation on Client Vocational Awareness, Attitude and Compet 414
RNA – see BIOCHEMICAL
RURAL
Expanded Public Assistance/Vocational Rehabilitation Service for Rural Public Assista 263
Rehabilitation of the Rural Public Assistance Recipient at a Comprehensive Rehabilit 262
RURAL AREAS
Systems Analysis of the Delivery of Rehabilitation Services in a Rural Setting 229

S
SCHIOTZ TONOMETER – see TONOMETER
SCHOOL
Effective Training in Rehabilitation Medicine in New Medical School Curricula 113
Factors Underlying Successful Adjustment of the Retarded Released from Institutions 400
Study of the Development and Change of Attitudes of Medical Students Throughout the 040
SCIENCE CURRICULUM – see CURRICULUM DEVELOPMENT
SCIENCE EDUCATION – see EDUCATION
SCOLIOSIS – see also SPINAL COLUMN
Collection and Analysis of Clinical Data on Scoliotic Patients 121
Development of an Optimal Discriminant Function for the Early Detection of Scoliosis 141
SEAT CUSHION – see REHABILITATION DEVICE
SEIZURE
Technology Assessment: Human Rehabilitation Techniques 403
SELF
Study of the Development and Change of Attitudes of Medical Students Throughout the 040
Voluntary Control of Autonomic Processes Using Biofeedback and Reinforcement Proce 056
SELF ADJUSTMENT
Crisis Intervention Rehabilitation Applied Research Program for the Severely Developmen 258
Factors Underlying Successful Adjustment of the Retarded Released from Institutions 400
Implications of the Socio-Cultural Background of Clients to Rehabilitational Personnel 159
Longitudinal Study of the Social, Vocational, Legal and Family Status of Young Adult Mer 259
Sociological Look at the Impact of Normalization 328
Study of the Development and Change of Attitudes of Medical Students Throughout the 040
SELF CARE
Crisis Intervention Rehabilitation Applied Research Program for the Severely Developmen 258
Evaluation of a Physical, Intellectual, and Emotional Personal Adjustment Training Progr 275

  Evaluation of the Relationship of Self-Care Outcomes to Care in the Acute Hospital. Th 055
  Factors Underlying Successful Adjustment of the Retarded Released from Institutions 400
  Functional, Social and Vocational Assessment of Surviving Persons with Documented 174
  Longitudinal Study of the Social, Vocational, Legal and Family Status of Young Adult Me 259
  Measuring Client Gain in Group Homes for the Retarded 321
  Sociological Look at the Impact of Normalization 328
  Study of the Development and Change of Attitudes of Medical Students Throughout the 040
  Technology Assessment: Human Rehabilitation Techniques 403
SELF-RATING QUESTIONNAIRE – see RATING SCALE
  QUESTIONNAIRE
SELF REGULATION – see SELF
SEMANTICS
  Semantic Analysis of Clinical Pain 102
SENILITY – see AGED
SENSITIVITY – see NERVE STUDY
SENSORIMOTOR FUNCTION – see MUSCLE STUDY
  NERVE STUDY
SENSORY AID SYSTEM
  Lateral Postural Control and Locomotor Performance in Normal Subjects and Patients 194
  Comparative Clinical Evaluation of Several EMG Processing Techniques 164
  Development of Standards and Principles for Visual Displays for Deaf Persons. The Vis 330
  Re-Evaluation of Sensory Testing in Neurological Patients 163
  Technology Assessment: Human Rehabilitation Techniques 403
SENSORY FEEDBACK
  Lateral Postural Control and Locomotor Performance in Normal Subjects and Patients 194
  Development of a Model Demonstration Rehabilitation Service 203
  Improvement of Function of Spastic and Stroke Patients by Means of Biofeedback 158
  Predictor Feedback Technology for Electromyographic Control of Prosthetic and Orth 173
  Technology Assessment: Human Rehabilitation Techniques 403
SENSORY HANDICAPS
  Application of Dynamic Palatography in Organic Speech Disorders 195
  Functional, Social and Vocational Assessment of Surviving Persons with Documented 174
  Identification of Deaf-Blind Individuals and the Development of Education & Rehabilit 392
  Technology Assessment: Human Rehabilitation Techniques 403
SENTENCE REPETITION TEST – see LEARNING
SEROTONIN – see BIOCHEMICAL
  CARDIAC
  MUSCLE STUDY
  VASCULAR DISORDER
SERVICE AGENCY – see AGENCY
  SERVICE DELIVERY
SERVICE DELIVERY
  Analysis of Public Assistance Social Services for the Mentally Retarded 324
  Assessment of the Social Service Needs of Deaf People in Connecticut 338
  Brown University-VR-CHIP-RT-7 Program 189
  Cognitive Assist in Motor Learning 156
  Conceptual Model of Planning and Evaluation of Rehabilitation Services 383
  Cost Analysis and Program Budgeting of Community Residential Facilities and Rehabilit 320
  Cost Analysis of the Rehabilitation of Severely Disabled Deaf Clients 346
  Evaluation of Three Citizen Advocacy Programs 396
  Factors Influencing Counselors Determination of Client Eligibility and Referral for Facili 417
  Factors Influencing Vocational Rehabilitation Counselor Utilization of Vocational Evalu 408
  Health Services for Developmentally Disabled Adults 376
  Model Casefinding, Counseling and Referral Program for Deaf People 332
  Process and Outcome in Cooperative School Programs in Texas 404
  Process and Outcome of Vocational Evaluation Services 412
  Rehabilitation Follow-up Program 380
  Research Needs in Vocational Rehabilitation 327

    Service Delivery Model for Deaf Inner City Residents 342
    Sociological Look at the Impact of Normalization 328
    State Rehabilitation Agency as a System Serving Community Hospital Patients 351
    Supervision in Vocational Rehabilitation 326
    Survey of Comprehensive Medical Rehabilitation Centers Serving the Most Severely [illegible]78
    Systems Analysis of the Delivery of Rehabilitation Services in a Rural Setting 229
    Technology Assessment Human Rehabilitation Techniques 403
SERVICE EVALUATION SYSTEMS – see EVALUATION
SERVICE REFERRALS – see also DISABILITY DETERMINATION
        SERVICE DELIVERY
    Factors Influencing Counselors Determination of Client Eligibility and Referral for Facili 417
    Factors Influencing Vocational Rehabilitation Counselor Utilization of Vocational Evalu 408
SEVERELY DISABLED – see DISABLED
SEXUAL FUNCTIONING
    Bibliography of Psychosocial, Vocational, and Sexual Aspects of Spinal Cord Injury 058
    Sexual Function in Physical Disability 041
    Study of the Development and Change of Attitudes of Medical Students Throughout the 040
SHELTERED WORKSHOP – see WORKSHOP
SHORT-TERM TRAINING – see TRAINING
SHOULDER – see EXTREMITY
SIGNIFICANT OTHER
    Factors Underlying Successful Adjustment of the Retarded Released from Institutions 400
    Family Unit as an Untapped Rehabilitation Force 306
    Sociological Look at the Impact of Normalization 328
    Study of the Development and Change of Attitudes of Medical Students Throughout the 040
SIGN LANGUAGE – see also COMMUNICATION
        INTERPRETER FOR THE DEAF
    Continuing Assessment of Programs for Preparation of Professionals to Work with Deaf Pe 331
    Development of Videotapes for Application in Training Rehabilitation Counselors to Work 344
    Learning Strategies of Deaf and Hearing Adults 339
    National Interpreter Training Consortium 345
SIMULATION MODEL – see MODEL
SINGLE MOTOR UNIT – see CELLULAR STUDY
        MUSCLE STUDY
SKELETAL SYSTEM DISABILITY – see also DISABLED
    Computer Characterization of Patient Services 204
    Effect of Cervical Orthoses on Cervical Spine Motion A Standardized Radiographic Met 065
    Engineering Analysis and Evaluation of a New Radial Palsy Splint 169
    Footwear and Posture Phases I-V 106
SKILL
    Cooperation and Competition Skills of the Institutionalized Mentally Retarded 393
    Development of a General Purpose Vocational Assessment Technique 388
    Factors Underlying Successful Adjustment of the Retarded Released from Institutions 400
    Process and Outcomes of Vocational Evaluation Services 412
    Social and Community Living Skill Training of Mentally Retarded Adults A Compariso 395
SKILLED MOVEMENT – see MOVEMENT and SKILL
SKIN DISORDER – see also PRESSURE SORE
        ULCER
    Application of Ozone to Infected Wounds and Pressure Sores and in the Managemen 019
    Evaluation of Various Seat Cushions Designed to Prevent Pressure Sores 081
    Investigation of Decubitus Ulcer as Manifestation of Psychosocial Problem 057
    Modular Hyperbaric Oxygen Treatment of Pressure Sores and Traumatic Skin Lesions o 032
    Pressure Ulcer Prediction and Prevention A New Procedure 374
    Topical Hyperbaric Oxygen Treatment of Pressure Sores and Certain Skin Ulcerations 020
    Zinc Sulphate in the Treatment of Various Skin Disorders 021
SMU – see CELLULAR STUDY
        MUSCLE STUDY

SOCIAL – see also SOCIOECONOMIC CLASS
    Community-Based Growth Group for Disabled Persons 044
    Effects of Different Types of Frustrating Conditions on the Behavior of Institutionalized 252
    Evaluation of Retarded Student Achievement in Career Education Programs 329
    Factors Underlying Successful Adjustment of the Retarded Released from Institutions 400
    Black Language Studies 175
    Implications of the Socio-Cultural Background of Clients to Rehabilitational Personnel and 159
    Measuring Client Gain in Group Homes for the Retarded 321
    Overcoming Disincentives to the Rehabilitation of SSI and SSDI Beneficiaries 367
    Role of Family in Institutional Rehabilitation of Clients with Behavioral and Physical Disabilities 220
    Sociological Look at the Impact of Normalization 328
    Study of the Development and Change of Attitudes of Medical Students Throughout the Time 040
SOCIAL SECURITY – see FEDERAL GOVERNMENT
    FINANCING
SOCIAL SERVICES – see SERVICE DELIVERY
SOCIAL SKILLS – see SKILL
SOCIOECONOMIC CLASS
    Analysis of Longitudinally Derived Data by a Programmed Statistical Package 247
    Black Language Studies 175
    Differential Appreciation of Color and Form by Young Children 246
    Information Transmission in the Mother-Child Dyad 242
    Oddity Discrimination in Young Children 245
    Overcoming Disincentives to the Rehabilitation of SSI and SSDI Beneficiaries 367
    Sociological Look at the Impact of Normalization 328
    Standardization of a Technique to Facilitate Indexing Differential Development in Pre-Literate 243
    Variables Related to the Attainment of Occupational Status Among Deaf Adults 340
    Word Association Among Low SES Children 251
SOCIOLOGY – see SOCIAL
SOCKET – see JOINT
    PROSTHESIS
SOMATOSENSORY EVOKED RESPONSE – see NERVE STUDY
SOURCEBOOK – see HANDBOOK
SPAIN REHABILITATION CENTER – see REHABILITATION CENTERS

SPASTICITY
    Control of Spasticity with EMG Biofeedback in the Incomplete Spinal Cord Injured Patient 111
    Development of a Model Demonstration Rehabilitation Service 203
    Electrophysiological Studies in Neuromuscular Diseases 022
    Further Studies of the Pathophysiology of Spasticity 192
    Gastrocnemius Muscle and Tendon Length in Normal and Stroke Patients 105
    Improvement of Function of Spastic and Stroke Patients by Means of Biofeedback 158
    Motor Conduction Velocity Measurement in Myotonic Distrophy 030
    Motor Point Blocks Phase III 103
    Multi-Electrode Studies of Patients with Spastic Central Nervous System Disorders 199
    Scientific and Clinical Testing of New Experimental Drugs 161
    Technology Assessment: Human Rehabilitation Techniques 403
SPECIAL EDUCATION – see EDUCATION
SPECIAL OLYMPICS
    Effects of Special Olympics Participation on Retarded Children, Families, and Community 401
SPEECH – see also SPEECH DISORDER
    Application of Dynamic Palatography in Organic Speech Disorders 195
    Berko Morphology 241
    Bibliography of Language Acquisition and Black Dialect 248
    Free Speech Language Analysis 239
    ITPA Testing of Milwaukee Children 240
    Linguaplatal Cues as an Aid to Consonant Articulation in Deaf Adults 373
    Modification of Nasality in Utterances of Deaf Speakers 360

  Modification of Speech Patterns of Normal and Dysarthric Speakers as a Function of Four 116
  Technology Assessment: Human Rehabilitation Techniques 403
SPEECH DISORDER
  Application of Dynamic Palatography in Organic Speech Disorders 195
  Functional, Social and Vocational Assessment of Surviving Persons with Documented 174
  Linguapiatal Cues as an Aid to Consonant Articulation in Deaf Adults 373
  Modification of Speech Patterns of Normal and Dysarthric Speakers as a Function of Four 116
  Modification of Nasality in Utterances of Deaf Speakers 360
  Prognosis in Recovery from Aphasia 228
  Technology Assessment: Human Rehabilitation Techniques 403
  Temporal Factors in Recovery from Aphasia 017
SPEECH THERAPY – see SPEECH DISORDER
  THERAPY
SPINAL BIFIDA – see SPINAL CORD DISORDER
SPINAL COLUMN
  Effect of Cervical Orthoses on Cervical Spine Motion: A Standardized Radiographic Me 065
  Technology Assessment: Human Rehabilitation Techniques 403
SPINAL CORD DISORDER – see also SPINAL CORD INJURY
  Applications of the Evoked Electrospinogram 193
  Atlas of Vocational Histories of Persons with Spinal Cord Injuries 054
  Cybernetic Study to Control Spinal Reflex Activity in Spinal Cord Injured Patients 129
  Electrophrenic Nerve Stimulation – A Feasibility Study 125
  Enterobacterial Vaccine as a Means of Controlling Infections in Spinal Cord Injured Pa 127
  Investigation of the Cause of Abnormal Electrolyte Distribution and Excretion in Men w 123
  Immediate Stabilization of the Fractured Thoracic and Lumbar Spine with and without 146
  Further Studies of the Pathophysiology of Spasticity 192
  Longitudinal Study of Depressive Reactions in Persons with Spinal Cord Injuries 132
  Role of Neurotransmitters in Spasticity Genesis 379
  Studies of Urologic Function in Patients Following Spinal Cord Injuries 045
  Technology Assessment: Human Rehabilitation Techniques 403
SPINAL CORD INJURY – see also SPINAL CORD DISORDER
  Applications of the Evoked Electrospinogram 193
  Appropriate Entry Level Jobs and Sheltered Workshop Tasks for the less Educated, Sev 147
  Assessment and Evaluation of Home Health Team Activities 372
  Atlas of Vocational Histories of Persons with Spinal Cord Injuries 054
  Attempted Dissolution of Struvite (MGNH4PO4 6H20) Urinary Calculi 131
  Bibliography of Psychological, Vocational, and Sexual Aspects of Spinal Cord Injury 058
  Bone Mineralization in Spinal Cord Injured Man: A Biochemical and Radiologic Investig 025
  Clinical Assessment of Psychological Adjustment to Spinal Cord Injury 365
  Comparison of Pneumatic and Conventional Double Upright Orthoses 090
  Control of Spasticity with EMG Biofeedback in the Incomplete Spinal Cord Injured Pa 111
  Cybernetic Study to Control Spinal Reflex Activity in Spinal Cord Injured Patients 129
  Development and Evaluation of Automatic Warning Device to Help Prevent Pressure Ul 359
  Development and Evaluation of a Self-Instructional Physical Fitness Training Program for 293
  Development of Electronic Systems to Provide Increased Vocational Independence 034
  Dysfunctions of Endocrine Glands in Spinal Cord Injury 027
  Effect of Cervical Orthoses on Cervical Spine Motion: A Standardized Radiographic M 065
  Effect of Disodium Etidronate (Diphosphonate) on Acute Osteoporosis 354
  Effect of Disodium Etidronate on the Recurrence of Ectopic Calcification Following Su 361
  Effectiveness of Instructional Units in Describing Architectural Barriers for Residence Sele 092
  Electromyographic and Cystometrographic Study of Human Bladder 382
  Electromyographic Findings in the Upper and in the Lower Motor Neuron Diseases: 355
  Electrophrenic Nerve Stimulation – A Feasibility Study 125
  Energy Expenditures while Performing Normal Street Walking – A Comprehensive S 366
  Enterobacterial Vaccine as a Means of Controlling Infections in Spinal Cord Injured P 127
  Evaluation of Long-Term Urinary Sterilization in Catheter-Free Paraplegics 362
  Evaluation of Various Electronic Devices to Increase Mobility and Independence of Ver 028

Environmental Enhancement Through Adaptive Aids for the Severely 089
Feedback Control System for the Paralyzed 037
Follow-up Study of the Psychological, Social and Vocational Adjustment of Spinal Co 053
Functional Achievement Evaluation RIC Tenodesis Splint 375
Further Studies of the Pathophysiology of Spasticity 192
H-Reflex as an Indicator of Spinal Center Integrity 357
Immediate Stabilization of the Fractured Thoracic and Lumbar Spine With and Witho 146
Importance of Central and Peripheral Temperatures in Maintaining Euthermic in Patient 364
Investigation of Decubitus Ulcer as Manifestation of Psychosocial Problem 057
Investigation of the Cause of Abnormal Electrolyte Distribution and Excretion in Men w 123
Localization of Urinary Tract Infection by Identifying Bacterial Antibody — Coating wit 363
Longitudinal Analysis of Patient Behavior 139
Longitudinal Study of Depressive Reactions in Persons with Spinal Cord Injuries 132
Long-Term Follow-up Studies of Patients with Spinal Cord Injury who Became Catheter 369
Pain in Spinal Cord Injury 370
Preliminary Investigation of Micrographic Viewer for Use by Disabled Persons 371
Pressure Ulcer Prediction and Prevention: A New Procedure 374
Prevention of Urinary Tract Infection in Spinal Cord Injury 385
Research on the Psychosocial and Vocational Adjustment of Spinal Cord Injured Clie 285
Retention of Habituation of Reflex Activity Mediated by the Transected Human Spinal C 145
Role of Family in Institutional Rehabilitation of Clients with Behavioral and Physical Disabi 220
Role of Neurotransmitters in Spasticity Genesis 379
Short Leg Bracing in Selected Cases of Crouch Gait 093
Studies of Urologic Function in Patients Following Spinal Cord Injuries 045
Sympathetic Activity and the Metabolism of Biogenic Amines in Spinal Cord Injured Pati 026
Technology Assessment: Human Rehabilitation Techniques 403
Treatment of the Neurogenic Dysfunctional Bladder by Implantable Artificial Sphincter 144

SPINAL CURVATURE — see SPINAL COLUMN
SPINAL NERVE CONDUCTION — see NERVE STUDY
SPINAL SHOCK — see SPINAL CORD INJURY
SPIROMETRY — see RESPIRATION
SPLINT — see ORTHOSIS
PROSTHESIS
STAFF ATTITUDE — see ATTITUDE
STAFF DEVELOPMENT TRAINING — see TRAINING
STAFFING — see PERSONNEL
STANDARDS OF CARE — see QUALITY ASSURANCE
STATE AGENCY — see also AGENCY

Assessment of the Social Service Needs of Deaf People in Connecticut 338
Cost Analysis of the Rehabilitation of Severely Disabled Deaf Clients 346
Crisis Intervention Rehabilitation Applied Research Program for the Severely Developmen 258
Determining the Feasibility of a National Cooperative for the Development and Distributio 336
Implementation of the Model State Plan for Vocational Rehabilitation of Deaf Clients 337
Medical Information System as a Communication Link the State Agency Medical Rec 353
Model State Plan Inventory 341
Program Evaluation Methods for State Vocational Rehabilitation Agencies 269
Program Evaluation — Modular Information System to Evaluate Rehabilitation 310
Research Needs in Vocational Rehabilitation 327
State Agency Rehabilitation Counselor Functions and the Mentally Retarded 405
State Rehabilitation Agency as a System Serving Community Hospital Patients 351
Supervision in Vocational Rehabilitation 326
Survey of the Subsystems in the State Rehabilitation Agency District Office 352
R-300: A Vocational Rehabilitation Profile (A Model for Assessing How Vocational 307

ST. MARY'S JUNIOR COLLEGE — see EDUCATION
STATE INSTITUTIONS — see AGENCY
INSTITUTION

STATE PLAN
  Analysis of Public Assistance Social Services for the Mentally Retarded 324
  Assessment of the Social Service Needs of Deaf People in Connecticut 338
  Brown University-VR-CHIP-RT-7 Program 189
  Determining the Feasibility of a National Cooperative for the Development and Distributio 336
  Implementation of the Model State Plan for Vocational Rehabilitation of Deaf Clients 337
  Model State Plan Inventory 341
STATISTICS
  Analysis of Longitudinally Derived Data by a Programmed Statistical Package 247
  Computer Characterization of Patient Services 204
  Functional, Social and Vocational Assessment of Surviving Persons with Documented 174
  Studies of Urologic Function in Patients Following Spinal Cord Injuries 045
  R-300: A Vocational Rehabilitation Profile (A Model for Assessing How Vocational 307
STEREOPHOTOGRAMMETRY – see DIAGNOSIS
STEROID – see BIOCHEMICAL
STONES – see KIDNEY DISORDER
STIMULATION
  Vibrotactile Learning with Mentally Retarded Subjects 391
STRENGTH
  Functional Achievement Evaluation RIC Tenodesis Splint 375
  Physiologic Responses of Hemiparetic Patients to Specific Exercise Stress 168
  Quantitative Studies of Muscular Strength and Muscular Work 050
  Study of the Development and Change of Attitudes of Medical Students Throughout the 040
STRESS
  Electromyographic Activity in Chronic Tension States 076
  Physiologic Responses of Hemiparetic Patients to Specific Exercise Stress 168
  Study of the Development and Change of Attitudes of Medical Students Throughout the 040
STROKE
  Application of Dynamic Palatography in Organic Speech Disorders 195
  Computer Aided Motor Communication for the Severely Disabled Non-Verbal 182
  Diagnosis and Remediation of Deficits in Visual Information Processing and Verbal 035
  Electromyographic Findings in the Upper and in the Lower Motor Neuron Diseases: A 355
  Evaluation of the Potential Therapeutic Effects of Applying Electrical Stimulation to th 140
  Evaluation of the Relationship of Self-Care Outcomes to Care in the Acute Hospital, t 055
  Externally Controlled Modification of the Impaired Ambulation of Hemiparetic Patients b 130
  Functional Skills Remediation in Hemiplegia Assessment Model for Eye-Hand Skills 005
  Functional, Social and Vocational Assessment of Surviving Persons with Documented 174
  Further Studies of the Pathophysiology of Spasticity 192
  Gastrocnemius Muscle and Tendon Length in Normal and Stoke Patients 105
  H-Reflex as an Indicator of Spinal Center Integrity 357
  Hypercoagulable State in Thrombotic Disease 010
  Improvement of Function of Spastic and Stroke Patients by Means of Biofeedback 158
  Ischemic Cerebrovascular Disease Study 011
  Physiologic Responses of Hemiparetic Patients to Specific Exercise Stress 168
  Pilot Project: Stroke in the Young 222
  Prognosis in Recovery from Aphasia 228
  Project to Provide Systematic Follow-Along to Persons Medically Rehabilitated in Fall 167
  Rehabilitation Potential of Stroke Patients as a Function of Cerebral Lesion, Visualize 219
  Research Developments of Lower Extremity Orthotic Systems for Patients with Various 124
  Scientific and Clinical Testing of New Experimental Drugs 161
  Study of Cortical Organization Using Visual and Somatosensory Evoked Potentials 217
  Technology Assessment: Human Rehabilitation Techniques 403
  Temporal Factors in Recovery from Aphasia 017
STUDENT
  Effective Training in Rehabilitation Medicine in New Medical School Curricula 113
  Study of the Development and Change of Attitudes of Medical Students Throughout th 040
STUTTERING – see SPEECH DISORDER

SUB-SCALES – see EVALUATION
SUPERVISION – see MANAGEMENT
PERSONNEL
SUPERVISORY EVALUATION – see EVALUATION
SUPERVISORY PRACTICES/SELECTION – see MANAGEMENT
PERSONNEL
SUPPLEMENTAL SECURITY INCOME
Analysis of Public Assitance/Social Services for the Mentally Retarded 324
Supplemental Security Income and the Deaf Community 335
Technology Assessment: Human Rehabilitation Techniques 403
SURGERY – see also TRANSPLANT
Immediate Stabilization of the Fractured Thoracic and Lumbar Spine with and withou 146
Technology Assessment Human Rehabilitation Techniques 403
SURVEILLANCE STUDIES
Computer Retrieval of Data for Long Range Evaluation Studies of Medical Rehabilitat 180
Follow-Along Study of a Medically Disabled Population in Fall River, Massachusetts 179
Functional, Social and Vocational Assessment of Surviving Persons with Documented 174
SURVEY – see LITERATURE SURVEY
SWITCH SYSTEM – see REHABILITATION DEVICE
SYNOBITIS – see ALLERGIC DISORDER
JOINT SYPHILITIC – see also PATHOGENIC BACTERIA
SYSTEMS ANALYSIS – see EVALUATION

T

TASK PERFORMANCE RATING – see PERFORMANCE
RATING SCALE
TEACHING
Comparison of Differential Modeling Strategies in Counselor Training 277
Continuing Assessment of Programs for Preparation of Professionals to Work with Deaf 331
Crisis Intervention Rehabilitation Applied Research Program for the Severely Develop 258
Development of a Competency-Based Staff Development Program for Vocational Ev 416
Development of Stimulus Material for Research and Teaching Apparatus 244
Effective Training in Rehabilitation Medicine in New Medical School Curricula 185
Evaluation of Halfway House Training Programs for the Mentally Retarded 390
Extending Rehabilitation Services to the Multiply Handicapped 402
Explore Means of Utilizing the Severely Disabled Homebound to Pool Rehabilitation S 209
Factors Influencing Patient Compliance in Patients with Ischemic Heart Disease 221
National System for Job Development in Micrographics 207
Predicting Rate of Acquisition and Production of Complex Industrial Tasks by Institutio 322
Study of the Development and Change of Attitudes of Medical Students Throughout t 040
Studies of Urologic Function in Patients Following Spinal Cord Injuries 045
Technology Assessment: Human Rehabilitation Techniques 403
Telecommunications in Training of Rehabilitation Facility Personnel 415
TEACHING APPARATUS – see AUDIOVISUAL AID
TEACHING TOOL
TEACHING TOOL – see also AUDIOVISUAL AID
Cognitive Assist in Motor Learning 156
Consumer Advocacy Project 171
Development of Stimulus Material for Research and Teaching Apparatus 244
Development of a Competency-Based Staff Development Program for Vocational Ev 416
Development of a Training Manual on Psychological Aspects of Disability 287
Development of Standards and Principles for Visual Displays for Deaf Persons. The Vis 330
Development of Videotapes for Application in Training Rehabilitation Counselors to 344
Electronically Aided Communication for the Severely Physically Disabled Non-Verbal 178
Evaluation of Halfway House Training Programs for the Mentally Retarded 390
Factors Influencing Counselors Determination of Client Eligibility and Referral for Facili 417
Factors Influencing Vocational Rehabilitation Counselor Utilization of Vocational Eval 408

Predictor Feedback Technology for Electromyographic Control of Prosthetic and Orth 173
Preliminary Investigation of Micrographic Viewer for Use by Disabled Persons 371
Technology Assessment: Human Rehabilitation Techniques 403
Telecommunications in Training of Rehabilitation Facility Personnel 415
TECHNICAL OBSOLESCENCE – see EMPLOYMENT
SKILL
TELECOMMUNICATIONS
Telecommunications in Training of Rehabilitation Facility Personnel 415
Electrocardiographic Monitoring with Telementry During Physical Therapy 014
Technology Assessment: Human Rehabilitation Techniques 403
TELETYPEWRITER
Explore Means of Utilizing the Severely Disabled Homebound to Pool Rehabilitation S 209
Job Development and Enhanced Productivity for Severely Disabled 218
Technology Assessment: Human Rehabilitation Techniques 403
TELEVISION
Determining the Feasibility of a National Cooperative for the Development and Distr 336
Development and Application of New Testing Procedures to the Study of Captions a 334
Development of Standards and Principles for Visual Displays for Deaf Persons. The Vis 330
Technology Assessment: Human Rehabilitation Tenhniques 403
TELEVISION PHONE
Technology Assessment: Human Rehabilitation Techniques 403
TEMPERATURE
Importance of Central and Peripheral Temperatures in Maintaining Euthermia in Patie 364
Pressure Ulcer Prediction and Prevention: A New Procedure 374
Voluntary Control of Autonomic Processes Using Biofeedback and Reinforcement Pro 056
TENDON – see MUSCLE STUDY
TENODESIS SPLINT – see ORTHOSIS
PROSTHESIS
TENOTOMY – see MUSCLE STUDY
TENSION – see STRESS
TESTS – see EVALUATION
MEASUREMENT
RATING SCALE
TEXT – see HANDBOOK
TEXTBOOK – see HANDBOOK
THERAPY – see also ANTIMALARIAL THERAPY
DRUG THERAPY
OCCUPATIONAL THERAPY
PHYSICAL THERAPY
PSYCHOTHERAPY
Application of Dynamic Palatography in Organic Speech Disorders 195
Computer Aided Motor Communication for the Severely Disabled Non-Verbal 182
Effects of Specific Cutaneous Cold Stimulation on Motor Control in Cat and Man 150
Electrocardiographic Monitoring with Telementry During Physical Therapy 014
Electronically Aided Communication for the Severely Physically Disabled Non-Verbal 178
Evaluation of the Feasibility of a Twelve Week Physiologically Paced Conditioning Pro 183
Evaluation of Advanced Designs of Microwave Diathermy Applicators 068
Exercise Prescription in the Hospital 350
Improvement of Function of Spastic and Stroke Patients by Means of Biofeedback 158
Mapping of Microwave Fields Surrounding Human Subjects Under Diathermy Treatme 120
Measurement of Musculature Blood Flow Induced By Microwave Diathermy 119
Modification of Nasality in Utterances of Deaf Speakers 360
Quantitative and Qualitative Evaluation of Muscular Hypertonia in Patients with Centr 047
Scientific and Clinical Testing of New Experimental Drugs 161
Study of the Development and Change of Attitudes of Medical Students Throughout t 040
Technology Assessment: Human Rehabilitation Techniques 403
Training Program for Upper Extremity Activities in Athetoid Patients 049
Zinc Sulphate in the Treatment of Various Skin Disorders 021

THEORY – see EVALUATION
THIGH – see also EXTREMITY
  Temperature Measurement in the Human Thigh During the Application of Hot or Cold 104
THROMBOSIS – see CARDIAC DISORDER
  VASCULAR DISORDER
THROMBOTIC CEREBROVASCULAR DISEASE – see VASCULAR DISORDER
THYROXINE – see HORMONE
TISSUE STUDY – see also CELLULAR STUDY
  Role of Neurotransmitters in Spasticity Genesis 379
TOKEN ECONOMY – see MOTIVATION
TONGUE – see FACIAL DISORDER
  SPEECH
TRAINEE – see CLIENT
  PERSONNEL
  TRAINING
TRAINER – see PERSONNEL
  TRAINING
TRAINING
  Application of Personal Achievement Skills to Personal Adjustment Training for the Blin 292
  Comparison of Differential Modeling Strategies in Counselor Training 277
  Consumer Involvement and Policy Development Consultation: A Resource Manual for 294
  Contributions of Personal Achievement Skills to Work Adjustment Training 279
  Crisis Intervention Rehabilitation Applied Research Program for the Severely Develop 258
  Developing a Model for the Analysis of Case Movement in a Vocational Rehabilitatio 297
  Development and Evaluation of an Interpersonal Skills Training Package 288
  Development and Evaluation of a Self-Instructional Physical Fitness Training Program f 293
  Development and Evaluation of a Set of Systematic Training Units to Increase or Decr 298
  Development and Evaluation of a Systematic Physical Fitness Training Program for 278
  Development and Evaluation of a Training Package in Program Evaluation 296
  Development of a Competency-Based Staff Development Program for Vocational 416
  Development of a Training Manual on Psychological Aspects of Disability 287
  Development of Videotapes for Application in Training Rehabilitation Counselors to 344
  Effective Training in Rehabilitation Medicine in New Medical School Curricula 113
  Effective Training in Rehabilitation Medicine in New Medical School Curricula 358
  Effects of Special Olympics Participation on Retarded Children, Families, and Commu 401
  Evaluation of a Physical, Intellectual, and Emotional Personal Adjustment Training Pro 275
  Evaluation of Halfway House Training Programs for the Mentally Retarded 390
  Facilitative Case Management in Rehabilitation 271
  Follow-up Study of Rehabilitation Short-Term Training 325
  Increasing Research Utilization Through the Development of Training Packages 303
  Investigation of the Mentally Retarded Clients Both Rehabilitated and Nonrehabilitate 256
  Measuring Client Gain in Group Homes for the Retarded 321
  National Interpreter Training Consortium 345
  Preparation of a Training Manual Psychology of Deafness 267
  Prevention of Urinary Tract Infection in Spinal Cord Injury 385
  Rehabilitation Counseling: Development and Evaluation of a Comprehensive Counsel 299
  Serving Deaf Rehabilitation Clients: Fundamentals of Communication 273
  Social and Community Living Skill Training of Mentally Retarded Adults: A Compariso 395
  Studies of Urologic Function in Patients Following Spinal Cord Injuries 045
  Study of the Development and Change of Attitudes of Medical Students Throughout t 040
  Survey of Staff Development Activities in State Rehabilitation Agencies 283
  Telecommunications in Training of Rehabilitation Facility Personnel 415
  Training Evaluation Kit 323
  Use of Self-Instructional Training Material with Rehabilitation Personnel 286

TRANSFER (CAR) – see MOBILITY LIMITED
  TRANSPORTATION

TRANSFORMATIONAL GRAMMAR – see LEARNING
SPEECH
TRANSPLANT – see also SURGERY
- Homotransplantation of Total Hip Joint Articular Cartilage in Dogs 176
- Survey of the Rehabilitation and Employment Problems of Hemodialysis Patients 231

TRANSPORTATION – see also MOBILITY LIMITED
- Black Language Studies 175

TREADMILL – see PHYSICAL ACTIVITY
TREATMENT – see THERAPY
TRIAL OF VOIDING – see URINARY DISORDER
TRIGLYCERIDE – see BIOCHEMICAL

U

ULCER – see also PRESSURE SORE
SKIN DISORDER
- Application of Ozone to Infected Wounds and Pressure Sores and in the Manageme 019
- Development and Evaluation of Automatic Warning Device to Help Prevent Pressure Ulc 359
- Evaluation of Various Seat Cushions Designed to Prevent Pressure Sores 081
- Investigation of Decubitus Ulcer as Manifestation of Psychosocial Problem 057
- Studies of Urologic Function in Patients Following Spinal Cord Injuries 045
- Topical Hyperbaric Oxygen Treatment of Pressure Sores and Certain Skin Ulcerations 020

ULTRASONIC NEBULIZATION – see THERAPY
ULTRASOUND
ULTRASOUND
- Echocardiographic Assessment of Ventricular Motion During Exercise 234
- Effects of Ultrasound on Bone Healing 067
- Postoperative Care of Patients with Total Hip Joint Replacement Using Ultrasound 096
- Temperature Measurement in the Human Thigh During the Application of Hot or Cold Pa 104

ULTRASTRUCTURE – see CELLULAR STUDY
UNEMPLOYED – see EMPLOYMENT
UNSTABLE FEET – see AMBULATION
EXTREMITY
UPPER EXTREMITY – see EXTREMITY
UPPER MOTOR NEURON LESION – see NERVE DISORDER
URBAN PROBLEM
- Black Language Studies 175
- Establishment of the High-Risk Population Laboratory 257
- Service Delivery Model for Deaf Inner City Residents 342
- Study of Emotional Forces in Psychogenic Asthma 216

URIC ACID – see BIOCHEMICAL
URINARY BLADDER
- Electromyographic and Cystometrographic Study of Human Bladder 382
- Evaluation of Long-Term Urinary Sterilization in Catheter-Free Paraplegics 362
- Localization of Urinary Tract Infection by Identifying Bacterial Antibody-Coating with 363
- Long-Term Follow-up Studies of Patients with Spinal Cord Injury who Became Catheter F 369
- Prevention of Urinary Tract Infection in Spinal Cord Injury 385
- Renal Scintillation Camera Studies as a Method of Following Renal Function and Urolo 368
- Studies of Urologic Function in Patients Following Spinal Cord Injuries 045
- Use of an Intraurethral Catheter to Provide Urinary Drainage 128

URINARY DISORDER
- Application of Ozone to Infected Wounds and Pressure Sores and in the Managemen 019
- Attempted Dissolution of Struvite (MGNH4PO4 6H20) Urinary Calculi 131
- Clinical Studies of Calcium in Quadriplegia, Collagen Metabolites and Bone Related 138
- Development of a System for Determination of Frequency and Volume of Urination in Pati 356
- Enterobacterial Vaccine as a Means of Controlling Infections in Spinal Cord Injured Pati 127

Evaluation of a Sonic Urinimeter for Blind Diabetics 149
Localization of Urinary Tract Infection by Identifying Bacterial Antibody-Coating with 363
Long-Term Follow-up Studies of Patients with Spinal Cord Injury who Became Catheter 369
Rehabilitation of the End-Stage Renal Disease Client – Selected Readings 295
Renal Scintillation Camera Studies as a Method of Following Renal Function and Urol 368
Studies of Urologic Function in Patients Following Spinal Cord Injuries 045
Survey of the Rehabilitation and Employment Problems of Hemodialysis Patients 231
Technology Assessment: Human Rehabilitation Techniques 403
Treatment of the Neurogenic Dysfunctional Bladder By Implanting Artificial Sphinct 144
Use of an Intraurethral Catheter to Provide Urinary Drainage 128
Use of Acetohydroxamic Acid (AHA) in Humans 135
URINARY SPHINCTER – see URINARY DISORDER
URINARY STERILIZATION
Evaluation of Long-Term Urinary Sterilization in Catheter-Free Paraplegics 362
Localization of Urinary Tract Infection by Identifying Bacterial Antibody-Coating with 363
Long-Term Follow-Up Studies of Patients with Spinal Cord Injury who Became Catheter 369
Studies of Urologic Function in Patients Following Spinal Cord Injuries 045
URINARY TRACT – see URINARY DISORDER
URINARY TRACT INFECTION – see INFECTION
PATHOGENIC BACTERIA
URINARY DISORDER
URINARY TRACT STONES – see URINARY DISORDER
URINATION – see URINARY DISORDER
URINE CULTURE – see INFECTION
PATHOGENIC BACTERIA
URINARY DISORDER
URINE FLOW MEASUREMENTS – see URINARY BLADDER
URINARY DISORDER
UROGENITAL TRACT DIAGNOSTIC PROCEDURES – see BLADDER DISORDER
URINARY DISORDER

V

VALSALVA MANEUVER – see RESPIRATION
VASCULAR DISORDER – see also CIRCULATION
Functional, Social and Vocational Assessment of Surviving Persons with Documented 174
Natural History of Deep-Vein Thrombosis in the Spinal Cord Injured 386
Objective Evaluation of Lower Limb Blood Flow and Circulatory Reflexes in Patients 015
Pressure Ulcer Prediction and Prevention: A New Procedure 374
Study of Cardiac Work Evaluation and Reconditioning After Myocardial Infarction 046
Technology Assessment: Human Rehabilitation Techniques 403
VERLO STANDING BRACE – see ORTHOSIS
PROSTHESIS
VERTIGO – see COORDINATION
VESICO-URETERAL REFLUX – see URINARY BLADDER
V-GAIT – see AMBULATION
VIBROTACTILE STIMULATION – see STIMULATION
VICARIOUS BEHAVIOR INDUCTION – see COUNSELING
VIDEOTAPE
Determining the Feasibility of a National Cooperative for the Development and Distributi 336
Developing an Empirically Based Training Program in Mental Retardation 397
Development of Videotapes for Application in Training Rehabilitation Counselors to Work 344
Information Transmission in the Mother-Child Dyad 242
VIEWER – see AUDIOVISUAL AID
TEACHING TOOL

VISUAL – see also AUDIOVISUAL AID
COMMUNICATION
EYE
INTERPRETER FOR THE DEAF
- Development of Standards and Principles for Visual Displays for Deaf Persons, The 330
- Motor Control and its Relationship to Functional Activities 202
- Response Oriented Sensory Aid for Assessment and Treatment of Oculomotor Dysfuncti 197
- Visual System Disorders and Functional Correlates 200
- Vibrotactile Learning with Mentally Retarded Subjects 391

VISUAL ASPECTS OF REHABILITATION
- Application of Dynamic Palatography in Organic Speech Disorders 195
- Development and Application of New Testing Procedures to the Study of Captions and 334
- Technology Assessment: Human Rehabilitation Techniques 403

VISUALLY IMPAIRED – see VISUAL

VITAMIN – see NUTRITION

VOCATIONAL – see also EMPLOYMENT
WORK
- Assessing Vocational Aptitudes Using a Task Performance Rating Scale 407
- Atlas of Vocational Histories of Persons with Spinal Cord Injuries 054
- Clinical Component: Medical Complications of Patients with End Stage Renal Disease 223
- Continuing Assessment of Programs for Preparation of Professionals to Work with Deaf 331
- Development of a General Purpose Vocational Assessment Technique 388
- Development of a Model for Evaluating the Relationship between EMR Work/Study 317
- Development of Electronic Systems to Provide Increased Vocational Independence 034
- Evaluation of Retarded Student Achievement in Career Education Programs 329
- Effects of Vocational Evaluation Programming on the Vocational Development of Rural 409
- Explore Means of Utilizing the Severely Disabled Homebound to Pool Rehabilitation Ser 209
- Extending Rehabilitation Services to the Multiply Handicapped 402
- Factors Underlying Successful Adjustment of the Retarded Released from Institutions 400
- Followup Study of the Psychosocial, Social and Vocational Adjustment of Spinal Cord Inj 053
- Functional, Social and Vocational Assessment of Surviving Persons with Documented 174
- Job Development and Enhanced Productivity for Severely Disabled 218
- Measuring Client Gain in Group Homes for the Retarded 321
- National System for Job Development in Micrographics 207
- Predicting Rate of Acquisition and Production of Complex Industrial Tasks by Institutiona 322
- Process and Outcome in Cooperative School Programs in Texas 404
- Process and Outcomes of Vocational Evaluation Services 412
- Project Access 215
- Research Needs in Vocational Rehabilitation 327
- Research on the Psychosocial and Vocational Adjustment of Spinal Cord Injured Clien 285
- Technology Assessment: Human Rehabilitation Techniques 403
- Feedback Systems for Insuring Quality in Facility Based Services 411

VOCATIONAL EVALUATION – see EVALUATION
VOCATIONAL

VOCATIONAL REHABILITATION
- Analysis of Information Processing Training for the Severely Disabled
- Appropriate Entry Level Jobs and Sheltered Workshop Tasks for the Less Educated, Severely 143
- Assessing Vocational Aptitudes Using a Task Performance Rating Scale 147
- Atlas of Vocational Histories of Persons with Spinal Cord Injuries 407
- Bibliography of Psychosocial, Vocational, and Sexual Aspects of Spinal Cord Injury 054
- Brown University-VR-CHIP-RT-7 Program 058
- Clinical Component: Medical Complications of Patients with End Stage Renal Disease (SR-9) 189
- Vocational Component Vocational Barriers to End Stage Renal Disease Patients and 223
- Cluster Analysis of Personality Characteristics of Rehabilitation Clients 281
- Community Group Homes for the Developmentally Disabled 318
- Comprehensive Evaluation and Treadmill Exercise Testing in Treated Patients for Hypertension 208
- Comprehensive Evaluation of the Relationship Between Disability and Personality Functioning 289

Contributions of Personal Achievement Skills to Work Adjustment Training 279
Cost Analysis of the Rehabilitation of Severely Disabled Deaf Clients 346
Crisis Intervention Rehabilitation Applied Research Program for the Severely Development 258
Developing a Model for the Analysis of Case Movement in a Vocational Rehabilitation Sys 297
Developing an Empirically Based Training Program in Mental Retardation 397
Development and Evaluation of an Interpersonal Skills Training Package 288
Development and Evaluation of a Set of Systematic Training Units to Increase or Decre 298
Development of a Training Manual of Psychological Aspects of Disability 287
Development of a General Purpose Vocational Assessment Technique 388
Development of an Improved System for Measuring Client Outcome 290
Development of Videotapes for Application in Training Rehabilitation Counselors to Work 344
Determining the Feasibility of a National Cooperative for the Development and Distributio 336
Dimensions of Rehabilitation Outcome a Factor Analystic Study of Several Measures of C 284
Effect of Environmental Factors and Geographic Location on Vocational Rehabilitation 002
Effects of Vocational Evaluation on Client Vocational Awareness, Attitude and Compet 414
Effects of Vocational Evaluation on Vocational Rehabilitation 309
Effects of Vocational Evaluation Programming on the Vocational Development of Rural 409
Establishment of the High-Risk Population Laboratory 257
Evaluation of the RIDAC (Rehabilitation Initial Diagnosis and Assessment for Clients) Projec 291
Expanded Public Assistance/Vocational Rehabilitation Service for Rural Public Assista 263
Explore Means of Utilizing the Severely Disabled Homebound to Pool Rehabilitation Servi 209
Extending Rehabilitation Services to the Multiply Handicapped 402
Factors Influencing Vocational Rehabilitation Counselor Utilization of Vocational Evalu 408
Factors Underlying Successful Adjustment of the Retarded Released from Institutions 400
Feedback Systems for Insuring Quality in Facility Based Services 411
Field Testing of a Cardiac Evaluation Technique for Counselor Use in Vocational 230
Follow-Along Study of Clients Returned for Service to a State Rehabilitation Agency 170
Follow-up Study of the Psychological, Social and Vocational Adjustment of Spinal Co 053
Identification of Factors Affecting Behavioral Competency in a Comprehensive 302
Identification of Work Reinforcers Found in Sheltered Workshops and their Relationship 410
Implementation of the Model State Plan for Vocational Rehabilitation of Deaf Clients 331
Increasing Research Utilization Through the Development of Training Packages 303
Investigation of the Mentally Retarded Clients Both Rehabilitated and Nonrehabilitate 256
Rejected by Wisconsin DVR During FY 1974 218
Job Development and Enhanced Productivity for Severely Disabled 280
Measure of Suitability of Placement 332
Model Casefinding, Counseling and Referral Program for Deaf People 341
Model State Plan Inventory 207
National System for Job Development in Micrographics 212
Opening Science Careers to the Handicapped 343
Overcoming Barriers to Deaf Persons in Federal Government 367
Overcoming Disincentives to the Rehabilitation of SSI and SSDI Beneficiaries 270
Pattern-Probability Model for Predicting Client Outcome 222
Pilot Project: Stroke in the Young 322
Predicting Rate of Acquisition and Production of Complex Industrial Tasks by Institutionali 404
Process and Outcome in Cooperative School Programs in Texas 269
Program Evaluation Methods for State Vocational Rehabilitation Agencies 301
Program Evaluation Techniques in Vocational Rehabilitation Agencies and Facilities 215
Rehabilitation Counseling: Development and Evaluation of a Comprehensive Counseli 299
Rehabilitation of the Rural Public Assistance Recipient at a Comprehensive Rehabilita 262
Rehabilitation/Public Assistance Worker Attitudes and Client Outcome 264
Replication of Eber's Multivariate Analysis of a Vocational Rehabilitation System 266
Research Needs in Vocational Rehabilitation 327
Research on the Psychosocial and Vocational Adjustment of Spinal Cord Injured Clie 285
Serving Deaf Rehabilitation Clients: Fundamentals of Communication 273
Sociological Look at the Impact of Normalization 328
State Agency Rehabilitation Counselor Functions and the Mentally Retarded 405

  Supervision in Vocational Rehabilitation 326
  Survey of Staff Development Activities in State Rehabilitation Agencies 283
  Systematic Psychosocial Vocational Treatment Strategies in Vocational Rehabilitation 300
  Technology Assessment: Human Rehabilitation Techniques 403
  Towards a Placement System Empirically Established Through Criterion-Group Method: 312
  Training Evaluation Kit 323
  Use of Self-Instructional Training Material with Rehabilitation Personnel 286
  Vocational Follow-up of the Physically Restored Unemployed 387
  R-300: A Vocational Rehabilitation Profile (A Model for Assessing how Vocational 307
VOICE – see SPEECH
VOICE ACTIVATED TRANSDUCER
  Voice Activated Transducer for Severely Physically Disabled 188

W
WALKING – see AMBULATION
WARMTH – see EMOTION
WATER LOSS – see METABOLISM STUDY
WEAKNESS
  Functional, Social and Vocational Assessment of Surviving Persons with Documented C 174
  Quantitative Studies of Muscular Strength and Muscular Work 050
WELFARE – see also DISADVANTAGED
    FINANCING
  Analysis of Public Assistance/Social Services for the Mentally Retarded 324
  Expanded Public Assistance/Vocational Rehabilitation Service for Rural Public Assista 263
  Overcoming Disincentives to the Rehabilitation of SSI and SSDI Beneficiaries 367
  Rehabilitation/Public Assistance Worker Attitudes and Client Outcome 264
  Rehabilitation of the Rural Public Assistance Recipient at a Comprehensive Rehabilitatio 262
  Sociological Look at the Impact of Normalization 328
WELFARE RECIPIENT – see DISADVANTAGED
    WELFARE
WELFARE RECIPIENT AND WORKER ATTITUDE – see ATTITUDE
WHEELCHAIR – see also EQUIPMENT
    MOBILITY LIMITED
    REHABILITATION DEVICE
  Clinical Field Trials of the Emory Detachable Electric Powered Drive for the Standard W 160
  Evaluation of an Automated Training System for Wheelchair Pushups 051
  Evaluation of Various Electronic Devices to Increase Mobility and Independence of V 028
  Evaluation of Various Seat Cushions Designed to Prevent Pressure Sores 081
  Evaluation of Wheelchair Designs for Quadriplegic Patients 110
  Reducing Public Barriers of the Severely Handicapped 377
  Technology Assessment: Human Rehabilitation Techniques 403
WOMEN
  Study of the Development and Change of Attitudes of Medical Students Throughout th 040
WORK – see also EMPLOYMENT
    VOCATIONAL
  Assessing Vocational Aptitudes Using a Task Performance Rating Scale 407
  Atlas of Vocational Histories of Persons with Spinal Cord Injuries 054
  Behavioral Architecture: Ecological Designing of Facilities for the Mentally Retarded 389
  Contributions of Personal Achievement Skills to Work Adjustment Training 279
  Crisis Intervention Rehabilitation Applied Research Program for the Severely Developm 258
  Development of a General Purpose Vocational Assessment Technique 388
  Differential Treatment of Functional Disabilities in Work Adjustment Programming 413
  Effects of Vocational Evaluation on Client Vocational Awareness, Attitude and Comp 414
  Effects of Vocational Evaluation on Vocational Rehabilitation 309
  Effects of Vocational Evaluation Programming on the Vocational Development of Rur 409
  Employment Potential of the Severely Disabled Young Adult 157
  Evaluation of Retarded Student Achievement in Career Education Programs 329

Factors Influencing the Right Heart Failure of Patients with Chronic Pulmonary Disease 003
Factors Influencing Vocational Rehabilitation Counselor Utilization of Vocational Eval 408
Factors Underlying Successful Adjustment of the Retarded Released from Institutions 400
Functional, Social and Vocational Assessment of Surviving Persons with Documented 174
Identification of Work Reinforcers Found in Sheltered Workshops and their Relationshi 410
Investigation of the Mentally Retarded Clients both Rehabilitated and Nonrehabilitat 256
Job Development and Enhanced Productivity for Severely Disabled 218
Measuring Client Gain in Group Homes for the Retarded 321
National System for Job Development in Micrographics 207
Overcoming Barriers to Deaf Persons in Federal Government 343
Predicting Rate of Acquisition and Production of Complex Industrial Tasks by Instituti 322
Process and Outcome in Cooperative School Programs in Texas 404
Process and Outcomes of Vocational Evaluation Services 412
Quantitative Studies of Muscular Strength and Muscular Work 050
Research Needs in Vocational Rehabilitation 327
Study of the Development and Change of Attitudes of Medical Students Throughout 040
Towards a Placement System Empirically Established Through Criterion-Group Meth 312
Use of the Work Environment Scale to Describe a Rehabilitation Research and Train 274
Variables Related to the Attainment of Occupational status Among Deaf Adults 340
Vocational Follow-up of the Physically Restored Unemployed 387
Work Classification of Patients with Obstructive Pulmonary Diseases Following Rehab 023

WORK ADJUSTMENT – see ADJUSTMENT
WORK

WORK ENVIRONMENT SCALE – see ENVIRONMENT
WORK

WORKER – see PERSONNEL
WORK

WORKPLACE
Appropriate Entry Level Jobs and Sheltered Workshop Tasks for the Less Educated, 147
Crisis Intervention Rehabilitation Applied Research Program for the Severely Develo 258
Job Development and Enhanced Productivity for Severely Disabled 218
Process and Outcome in Cooperative School Programs in Texas 404
Technology Assessment: Human Rehabilitation Techniques 403
Use of the Work Environment Scale to Describe a Rehabilitation Research and Traini 274

WORK EVALUATION
Assessing Vocational Aptitudes Using a Task Performance Rating Scale 407
Crisis Intervention Rehabilitation Applied Research Program for the Severely Develop 258
Development of a General Purpose Vocational Assessment Technique 388
Effects of Vocational Evaluation on Client Vocational Awareness, Attitude and Comp 414
Effects of Vocational Evaluation on Vocational Rehabilitation 309
Effects of Vocational Evaluation Programming on the Vocational Development of Ru 409
Employment Potential of the Severely Disabled Young Adult 157
Extending Rehabilitation Services to the Multiply Handicapped 402
Factors Influencing Vocational Rehabilitation Counselor Utilization of Vocational Eval 408
Factors Underlying Successful Adjustment of the Retarded Released from Institutions 400
Investigation of the Mentally Retarded Clients both Rehabilitated and Nonrehabilitat 256
Job Development and Enhanced Productivity for Severely Disabled 218
National System for Job Development in Micrographics 207
Predicting Rate of Acquisition and Production of Complex Industrial Tasks by Institutio 322
Process and Outcome in Cooperative School Programs in Texas 404
Process and Outcomes of Vocational Evaluation Services 412
Use of the Work Environment Scale to Describe a Rehabilitation Research and Trainin 274
Work Classification of Patients with Obstructive Pulmonary Diseases Following Rehabi 023

WORKSHOP
Appropriate Entry Level Jobs and Sheltered Workshop Tasks for the Less Educated, Se 147
Behavioral Architecture: Ecological Designing of Facilities for the Mentally Retarded 389
Crisis Intervention Rehabilitation Applied Research Program for the Severely Develop 258

Development of a General Purpose Vocational Assessment Technique 388
Effects of Different Types of Frustrating Conditions on the Behavior of Institutionalized 252
Extending Rehabilitation Services to the Multiply Handicapped 402
Identification of Work Reinforcers Found in Sheltered Workshops and their Relationship 410
Investigation of the Mentally Retarded Clients both Rehabilitated and Nonrehabilitate 256
National System for Job Development in Micrographics 207
Predicting Rate of Acquisition and Production of Complex Industrial Tasks by Institution 322
Process and Outcomes of Vocational Evaluation Services 412
Research Needs in Vocational Rehabilitation 327
Vibrotactile Learning with Mentally Retarded Subjects 391

WORK/STUDY PROGRAM
Crisis Intervention Rehabilitation Applied Research Program for the Severely Develop 258
Evaluation of Retarded Student Achievement in Career Education Programs 329
Investigation of the Mentally Retarde[illegible]lients both Rehabilitated and Nonrehabilitat 256
Personal-Social Functioning of Cooperative Work-Study Students: Parent[illegible] Perspective 394
Process and Outcome in Cooperative School Programs in Texas 404

X

X-RAY – see RADIATION

Y

YOUTH – see CHILDREN

Z

ZINC SULPHATE TREATMENT – see THERAPY

PRINCIPAL INVESTIGATOR INDEX

Abstract No.

Acherman, Anne M. 221
Akridge, Robert L. 288,298,300
Alfred, W. 147
Anderson, Marjorie E. 069,084,085,115
Anderson, Thomas P. 039,057,059
Athelstan, Gary 053,058
Awad, Essam A. 048
Ayoub, Mohammed 403

Barker, J. N. 018
Basmajian, J. V. 151,158,161
Bell, Nancy J. 394,400
Bellamy, G. Thomas 322
Bensberg, Gerard J. 392,396,406
Bergofsky, Edward H. 001,002,003,004
Berni, Rosemarian 086,088,118
Betts, Henry B. 376
Beukelman, David R. 116,118
Bistevins, Rita 060
Bolton, Brian 267,272,276,278,284, 287,289,291
Bonge, Dennis 270
Braddock, David 319
Brammell, H. L. 162,225,232,233,234
Brena, S. F. 153
Brown, Halla 216
Browning, Philip 323,328

Cailliet, Rene 348,349,350
Campos, R. 140
Canzoneri, J., III 129
Cardus, D. 122,137
Carter, R. E. 125,127,142
Chang, Ethel 228
Chapman, Peter A. 181
Chyatte, Samuel B. 148,154,157
Claus-Walker, J. 123,139
Coker, Charles 408,413,415,416,417
Cole, J. 133,134
Cole, Theodore 041,042
Cook, Daniel 277,285
Cook, T. 191,194,196
Cooper, Paul G. 280,281,290,296,297
Corcoran, Paul 184
Coulter, Jane 399
Crewe, Nancy 044,054
Crochetiere, William J. 169

DeLateur, Barbara 070,072,081,103,106
Dickson, J. H. 146
Diller, Leonard 005,006,029,031,035
Dunn, Dennis 412,416

Abstract No.

Eberstein, Arthur 030
Engen, T. J. 124
English, William 326

Farley, Roy C. 286
Filley, Giles 227
Finley, F. Ray 190,205
Fischer, Boguslav H. 007,008,019,020, 021,032,036
Fisher, Steve 065
Flanigan, Patrick J. 254
Fletcher, Samuel G. 373
Flexer, Robert 390,402,404
Fordyce, W. E. 079,080,102,112
Foss, Gilbert 327
Foulds, Richard A. 178,182,188
Fowler, Roy S. 076,078,107,108
Freebairn, Thomas 344
Freedman, W. 202,206
Frisina, Warren 037
Fuhrer, Marcus J. 145

Gans, Bruce M. 094
Garber, Howard 236,237,238,239,240,241, 246,247,248,249,250,251
Gardner, William I. 252,258
Gersten, Jerome W. 229
Gerstman, Hubert L. 175
Gertler, Menard M. 010,011
Gilbert, C. A. 155
Glenn, Vernon L. 295
Gold, Calman 034
Goldberg, Richard T. 170
Gonnella, Carmella 156
Goodgold, Joseph 022
Granger, Carl V. 165,166,167,172, 179,180,189
Greenwood, Reed 262,264,301
Gresham, Glenn E. 174
Griffin, James C. 389
Griffith, D. P. 131,135,144
Guy, Arthur W. 097

Haas, Albert 023
Halar, Eugen M. 091,105
Halpern, Andrew 317
Halpern, Daniel 047,049
Harr[illegible]on, Byron 380
Harasymiw, S. 383,384
Harrington, P. R. 121
Hawkins, Donald E. 215
Heber, Rick F. 242,243,244,245,257,259

	Abstract No.
Helberg, L.	347,351,352,353
Herron, R. E.	141
Higgins, Jerry	360
Hill, Carole E.	159
Hofkash, Jack M.	013
Holzer, James F.	181
Hongladarom, Thaworn	067
Horning, Morris R.	087,093
Hoskins, Theresa	168,183
Huang, Chi-Tsou	366
Irvin, Larry	321,329
Itoh, Masayashi	014
Jackson, James R.	359,371
Johnson, Alvin P.	215
Kaplan, P.	382
Karan, Orv C.	256,258
Kelly, Gary	149
Kottke, Frederic J.	052,113
Kraft, George	071,077,083,098,099,109
Krauft, Conrad C.	261,263,265,266
Kreifeldt, John	164,173
Kubicek, William G.	046
Kuhlemeier, Keith V.	359,364
Kutner, Nancy	159
Kwatny, E.	197,200,204
Lavine, Robert A.	217
Lehmann, Justus F.	068,074,075,089,090, 096,101,104,110,117, 119,120,185
Lehneis, H. R.	024
Letbetter, William D.	150
Litvin, Mark	324
Locke, Bill J.	391
McDaniel, James W.	230,231,235
Majumder, Ranjit	306,308,310,313
Mallik, K.	207,209,212,218
Maloney, F. Patrick	224
Marcus, Margaret S.	365
Marr, Jack	260,302
Martin, Andrew S.	388,401,402
Martin, Jerry	061
Matheson, Nina	210,211
Mattson, M.	374
Mayer, N.	192,199,203
Means, Bob L.	283
Menz, Fredrick	409,410,411,414
Miller, John M., III	355
Milligan, G. Tim	293

	Abstract No.
Mital, Mohinder A.	176
Molanari, G. F.	219,222
Monster, A. W.	193,198,201
Moriarty, Joseph B.	316
Morris, Alfred	160
Mundale, Martin	050
Munro, Roger S.	128
Naftchi, N. Eric	025,026,207
Nepomuceno, C. S.	370
Nobles, Brenda	274
O'Connor, Gail	318,320
O'Leary, James	177
Orr, William	226
Ozel, Ali Turkyilmaz	043,063,064
Parham, Jerry D.	397,405
Parrish, Alvin E.	223
Patterson, Robert	051
Price, Mary	045
Reibetanz, Karen	253
Reich, Theobald	015
Reiss, David	220
Remmes, Harold S.	171
Rice, B. Douglas	273,294
Ritt, Beverly	375
Roberts, Alan H.	056,062
Roessler, Richard	268,275,279,292
Rosenberg, Pearl	040
Rubin, Stanford	269,271,299
Rudman, D.	152
Sahgal, V.	379
Sakalas, R.	387
Sanderson, M.	143
Sarno, Martha Taylor	017
Schein, Jerome D.	331,335,336,337,338, 339,341,343,345,346
Scheinkman, Norman	407
Schroedel, John G.	340
Sell, Heiner	028
Shapiro, B.	381
Sharp, J. T.	136
Sherwood, Sylvia	186
Sigelman, Carol K.	395,398,404
Silberberg, N.	066
Simmons, Gary	282
Smith, Michael A.	325
Spencer, William A.	130
Sperling, K.	055
Steger, Jeffrey	111

	Abstract No.
Stern, Melvin J.	213
Stewart, Alan	330,334
Stolov, Walter C.	100
Stover, Samuel L.	354,356,357,361,362, 363,367,368,369,372
Tamagna, Irene G.	208
Taylor, Jack B.	221
Taylor, Neal	082
Tichauer, Erwin R.	016,033
Traugh, George H.	366
Trotter, Martha	095
Tseng, M. S.	307,309,312
VandenBrook, Michael	255
Vineberg, Shalom	126

	Abstract No.
Walls, Richard T.	304,305,311,314,315
Warren, C. Gerald	073,114
Watson, Douglas	332,333,342
Werder, Pamela R.	393
Willems, E. P.	139,132
Wilson, Robert G.	038
Wittmeyer, Marilyn B.	092
Wolf, S. L.	162,163
Wolin, Steven J.	214
Wu, Y.	385
Yao, James	386
Yue, Robert H.	009,012
Zafran, J.	195

ADDRESSES OF THE RESEARCH AND TRAINING CENTERS

RT-1
Howard A. Rusk, M.D., Director
Joseph Goodgold, M.D., Director of Research
New York University (16-P-56801)
Medical Rehabilitation R&T Center
400 East 34th Street
New York, New York 10016

RT-2
Frederick J. Kottke, M.D., Director
Essam A. Awad, M.D., Ph.D., Director of Research
University of Minnesota (16-P-56810)
Medical Rehabilitation R&T Center
860 Mayo Building
Minneapolis, Minnesota 55455

RT-3
Justus F. Lehmann, M.D., Director
Wilbert E. Fordyce, Ph.D., Director of Research
University of Washington (16-P-56818)
Medical Rehabilitation R&T Center
15th Avenue, N.E.
Seattle, Washington 98195

RT-4
William A. Spencer, M.D., Director
Marcus J. Fuhrer, Ph.D., Director of Research
Baylor College of Medicine (16-P-56813)
Medical Rehabilitation R&T Center
1333 Moursund Avenue
Houston, Texas 77030

RT-6
Samuel B. Chyatte, M.D., Director
Carmella Gonnella, Ph.D., Director of Research
Emory University School of Medicine (16-P-56808)
Medical Rehabilitation R & T Center
1431 Clifton Rd.
Atlanta, Georgia 30322

RT-7
Paul J. Corcoran, M.D., Director
Fred A. Fay, Ph.D., Director of Research
Tufts University (16-P-57856)
Medical Rehabilitation R&T Center
171 Harrison Avenue
Boston, Massachusetts 02111

RT-8
Dorthea D. Glass, M.D., Director
Temple University (16-P-56804)
Medical Rehabilitation R&T Center
Suite 201,12th and Tabor Road
Philadelphia, Pennsylvania 19141

RT-9
Irene G. Tamagna, M.D., Director
Fred Leonard, Ph.D., Director of Research
The George Washington University (16-P-56803)
Medical Rehabilitation R&T Center
Room 714, Ross Hall
2300 Eye Street, N.W.
Washington, D.C. 20037

RT-10
H. L. Brammell, M.D., Director, Director of Research
University of Colorado Medical Center (16-P-46815)
Medical Rehabilitation R&T Center
4200 E. Ninth Avenue, Box C242
Denver, Colorado 80262

RT-11
Rick F. Heber, Ph.D., Director
University of Wisconsin (16-P-56811)
Mental Retardation Rehabilitation R&T Center
Waisman Center on Mental Retardation
and Human Development
2605 Marsh Lane
Madison, Wisconsin 53706

RT-13
Vernon L. Glenn, Ed.D., Director
Reed Greenwood, Ed.D.; Director of Research
University of Arkansas (16-P-56812)
Vocational Rehabilitation R&T Center
346 West Avenue Annex
Fayetteville, Arkansas 72701

RT-15
Joseph B. Moriarty, Ph.D., Director
Ranjit K. Majumder, Ph.D., Director of Research
University of West Virginia (16-P-56806)
Vocational Rehabilitation R&T Center
Institute, West Virginia 25112

RT-16
Andrew S. Halpern, Ph.D., Director
University of Oregon (16-P-56817)
Mental Retardation Rehabilitation
R&T Center
212 Clinical Services Building
Eugene, Oregon 97403

RT-17
Jerome D. Schein, Ph.D., Director
Alan L. Stewart, Ph.D., Director of Research
New York University (16-P-56802)
Deafness Rehabilitation R&T Center
80 Washington Square East
New York, New York 10003

RT-18
Rene Cailliet, M.D., Director
Loren A. Helberg, Ph.D., Director of Research
University of Southern California (16-P-56816)
Medical Rehabilitation R&T Center
School of Medicine
Room 102 No. Hall
1739 Griffin Avenue
Los Angeles, California 90031

RT-19
Samuel Stover, M.D., Director
Phillip R. Fine, Ph.D., Director of Research
University of Alabama (16-P-56807)
Medical Rehabilitation R&T Center
1717 Sixth Avenue, South
Birmingham, Alabama 35233

RT-20
Henry B. Betts, M.D., Director
Byron B. Hamilton, M.D., Director of Research
Northwestern University (16-P-56809)
Medical Rehabilitation R&T Center
Rehabilitation Institute of Chicago
345 East Superior Street
Chicago, Illinois 60611

RT-21
Gerard J. Bensberg, Ph.D., Director
Carol K. Sigelman, Ph.D., Director of Research
Texas Tech University (16-P-56819)
Mental Retardation Rehabilitation
R&T Center
P.O. Box 4510
Lubbock, Texas 79409

RT-22
Daniel C. McAlees Ph.D., Director
Charles Coker, Ph.D., Director of Research
University of Wisconsin-Stout (16-P-56821)
Vocational Rehabilitation R&T Center
Menomonie, Wisconsin 54751